Electrical World

JUNE 9, 1945

UNIVERSITY OF CALIFORNIA
JUN 2 0 1945
MURRAY

Featuring

at Users Think of -Type Transformers

survey of industrial d utility practice in- ving over 100,000 kva. 39 installations

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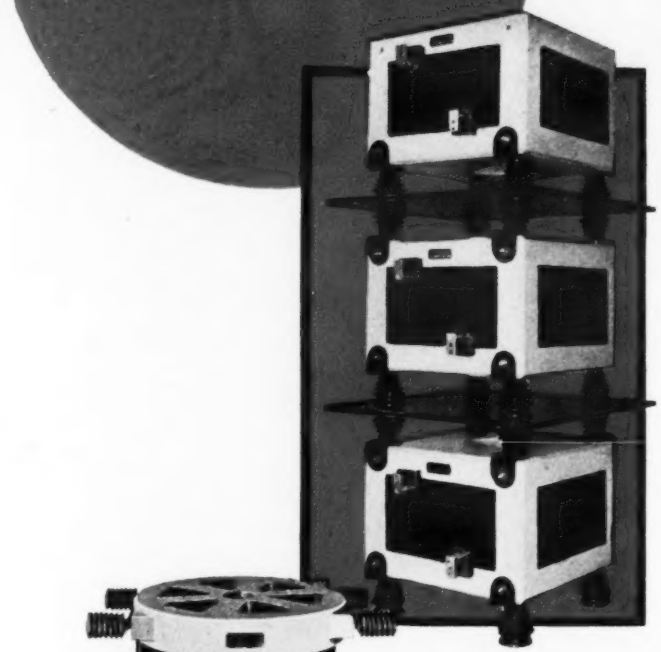
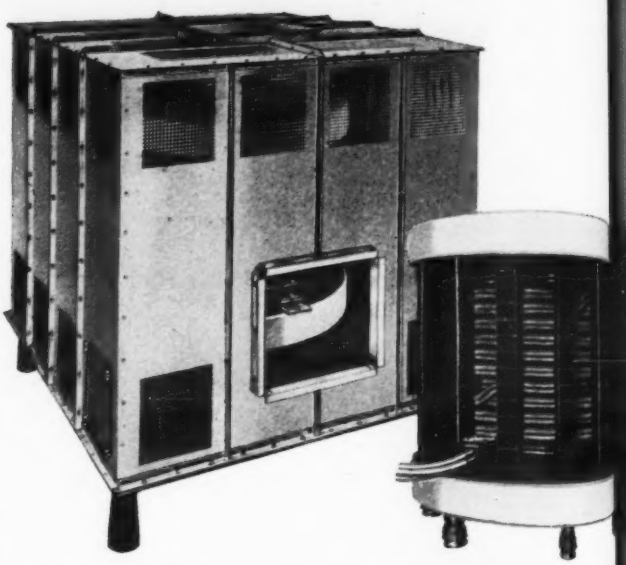
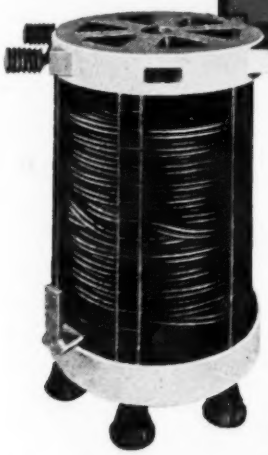
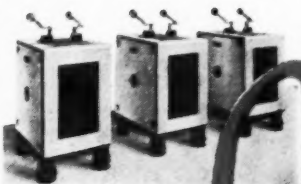
Lessen the THREAT of

powerflow INTERRUPTIONS!









THE ability of Murray Current Limiting Reactors to withstand severe short circuit conditions is a matter of record—since the first one was built in 1910. Their reliability and sturdiness have been proved—unquestionably.

Murray Reactors are "hand-tailored" to meet definite characteristics of the particular system. And if available space for their installation is limited as in crowded plants, their size is determined to suit the conditions.

Service records of Murray Low Loss Reactors disclose the clearing of the most severe short circuits, with the resultant saving of thousands of dollars in plant equipment, maintenance and operation.

Be prepared with Murray Reactors—their installations pays and pays well.

Metropolitan Device Corporation, Brooklyn, N. Y.

OTHER MURRAY DEVICES

Aerial Ladder
Cable Racks
Malleable Strapping
Meter Boxes
Meter Seals
Meter Switches
Panelboxes
Safety Switches
Testing Devices
Wiring Troughs

HIGHEST
All-Year Efficiencies

HIGHEST
Short Circuit Protection

LOWEST
Temperature Rises

Murray

—the foremost name on current-limiting

REACTORS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 71 YEARS

June 9, 1945 — Vol. 123, No. 23

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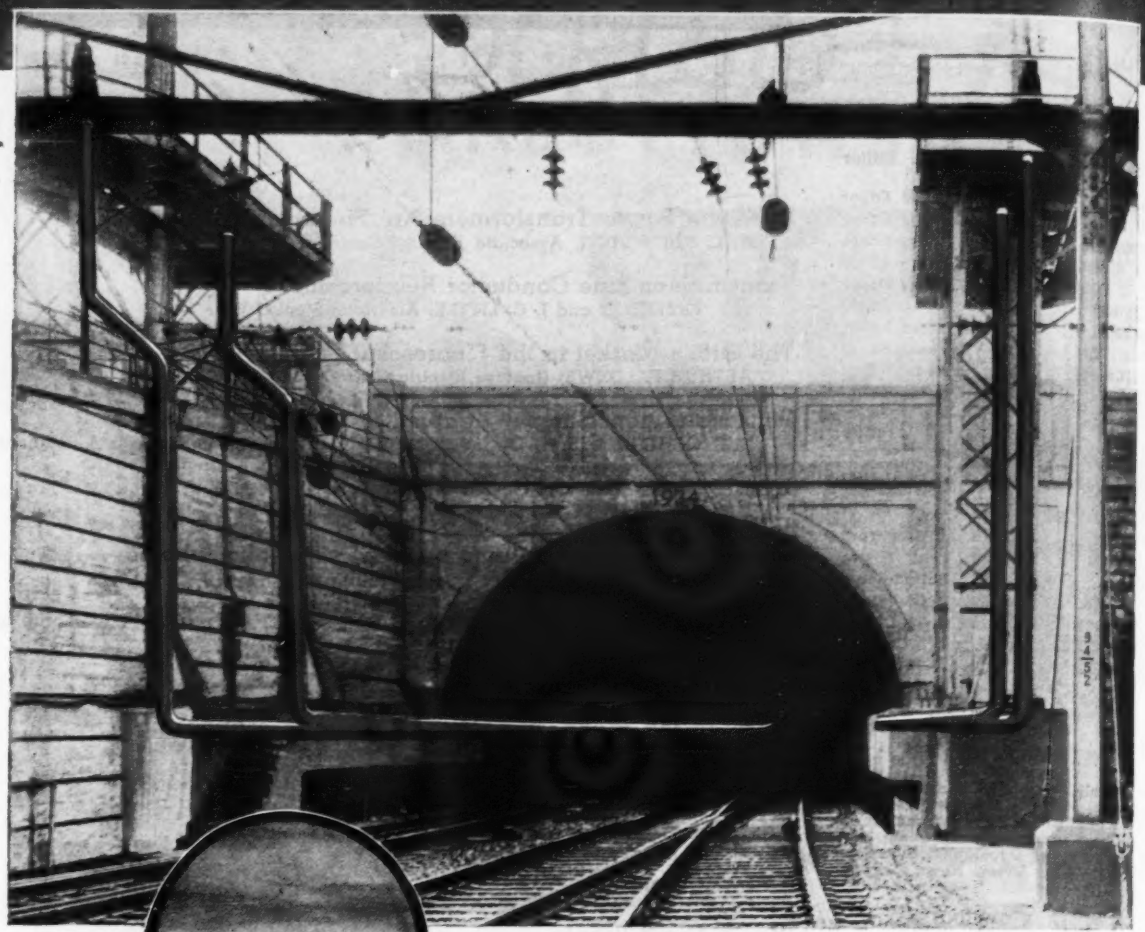
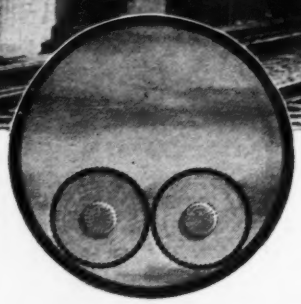
OILOSTATIC TRANSMISSION SYSTEM

10 years in service on the Pennsylvania Railroad!





• The installation diagrammed above consists of 2 single-phase (132 kv) circuits — each 3¼ miles long. Each circuit consists of 2 single conductor 500,000 CM cables in a 7" steel pipe filled with oil maintained under 200 lbs. static pressure. Maximum cable lengths pulled were approximately 4,000 ft.

IN FEBRUARY 1935, the Pennsylvania Railroad placed in operation the Oilostatic Electric Transmission System in its Baltimore tunnels to supply high voltage electric power for New York-Washington electrification. This system has functioned without service interruption.

In the Oilostatic Electric Transmission System, paper insulated cables are completely immersed in oil. Ruggedly constructed cables, in an oil-filled pipe line maintained under 200 lbs. static pressure, provide a simple, economical method of handling heavy loads at high voltages.

Oilostatic cable systems are suitable for electrical transmission in congested areas, for urgently needed tie-lines, for railroad electrification, for eliminating overhead construction near airports, and in tunnels and on bridges, for crossing swamps, rivers and other bodies of water.

For free literature which illustrates, diagrams, and describes the Oilostatic Electric Transmission System — or if you wish to talk over a possible installation — get in touch with our nearest district office or write to The Okonite Company, Passaic, New Jersey.

OKONITE-CALLENDER paper insulated power cables

4063

Line wire

As distributor of *Crapo* galvanized wire and strand, GRAYBAR offers you steel conductors which provide an unusual combination of advantages: high tensile strength, high fatigue endurance, and relatively low electrical resistance. These conductors are especially applicable to rural branch distribution lines. They make possible long spans with flat sags, reduce the number of pole structures required, cut over-all construction costs. They withstand heavy ice and wind loads, help minimize service interruptions and keep down maintenance expense.

Get prices and complete technical data from the GRAYBAR Outside Construction Specialist near you. Call him, too, for first-quality pole-line hardware, poles, crossarms, insulators, pins, accessories, and tools — all the supplies you need for line construction and maintenance. *Graybar Electric Company, Graybar Building, New York 17, N. Y.* 4532

Crapo HTC-130 Steel Conductors possess exceptionally high tensile strength, permit extra long spans. Furnished in sizes 4, 6 and 8 B.W.G. — solid or stranded (3-wire) — without splices or welds.

Crapo HTC-80 Steel Conductors are designed for shorter spans than *Crapo* HTC-130. Made in sizes 4, 6 and 8 B.W.G. — solid or stranded (3-wire) — without welds or joints.

IN OVER 80 PRINCIPAL CITIES

It's got everything

A HIGH-SPEED MOTOR NEEDS

- Smooth, streamlined appearance—
- Substantial cast iron frames and brackets—quiet, stiff, vibrationless—
- Rotor bearings rigidly braced from base—
- Rotor carefully balanced dynamically and statically—
- Rotor winding designed for the service required. Also patented Elliott diamond cage construction used where needed—
- Substantial, roomy conduit box—
- Construction minimizes windage and magnetic noises—
- Controlled ventilation assures cool operation—

The exceptional features which make this an outstanding motor, are fully covered in the bulletin —on request.

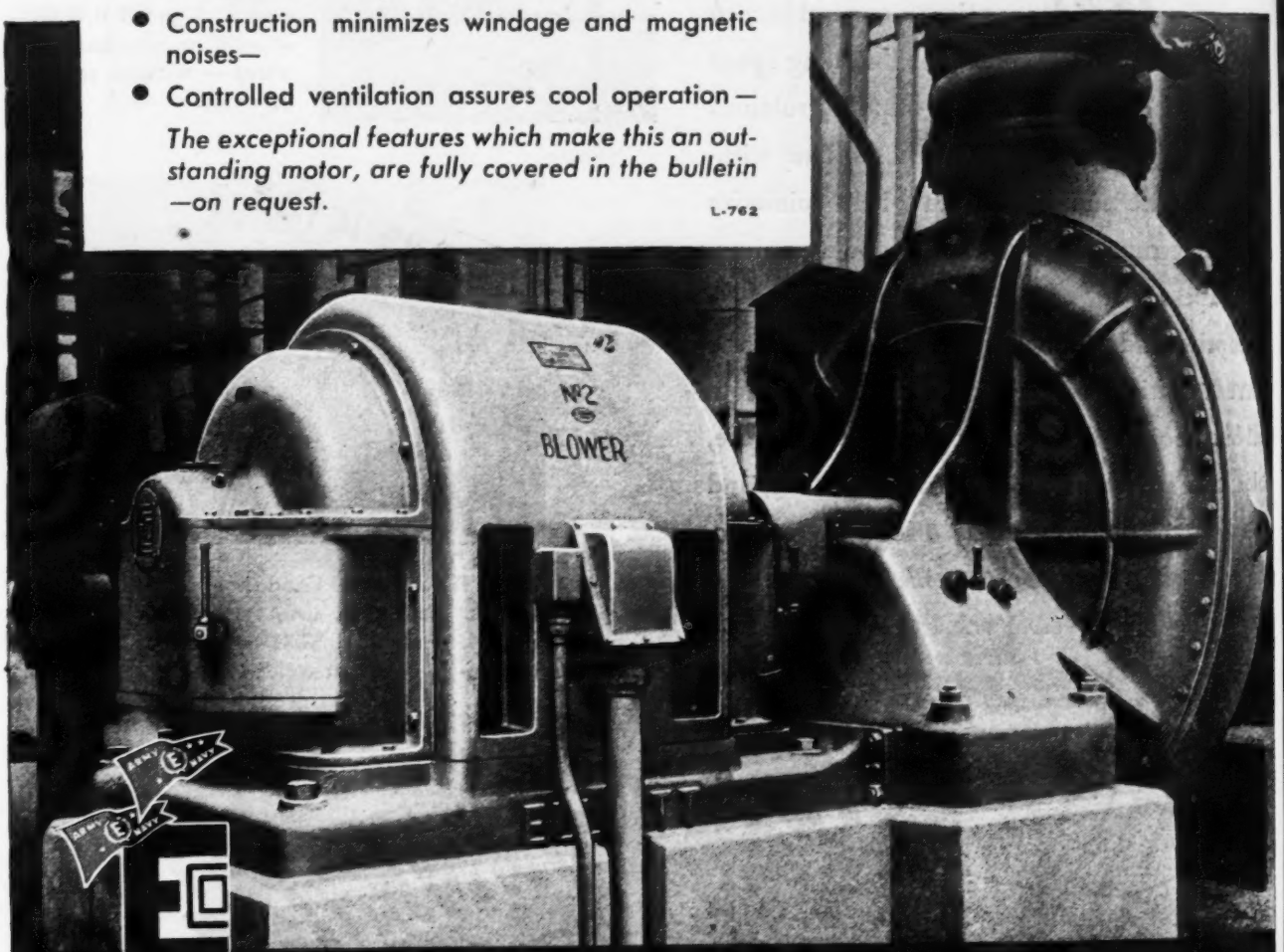
L-762

ELLIOTT

HIGH-SPEED, TWO-POLE MOTOR DRIVING ELLIOTT BLOWER

Supplying air for catalyst regeneration in the Thermofor Catalytic Cracking unit at the 10-7 plant of the Sun Oil Company in Marcus Hook, Pa.

This is a 350-hp splash-proof, squirrel-cage motor operating at 3560 rpm on 3-phase, 60-cycle, 2300-volt power. It is engineered to operate in the open, even to space heaters which prevent condensation on the windings when motor is not in use.



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Plants at JEANNETTE, PA. • RIDGWAY, PA.
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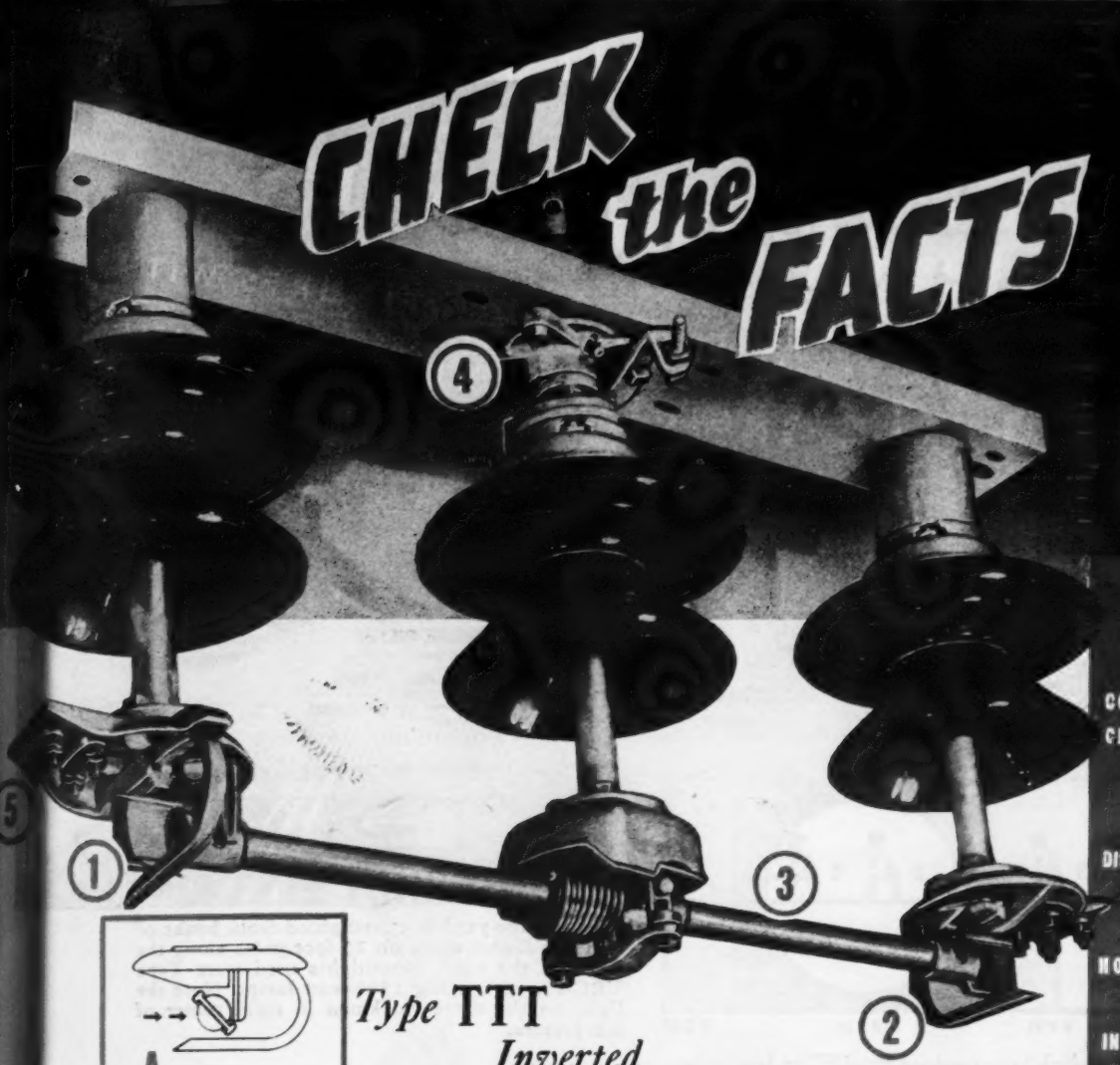
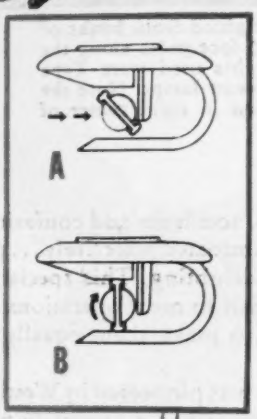
CHECK the FACTS





Type **TTT**
Inverted
DISCONNECTING SWITCH

1. Hi-Pressure Contact, self-cleaning contacts.
2. Blade enters contact jaws free (A) - stops - then rotates about its axis to produce Hi-Pressure (B).
   A - End view - blade in closed position.
   B - Contact closed under Hi-Pressure.
3. Continuous I. P. S. tubing - contact to contact.
4. Anti-friction, greaseless bearing for smooth, easy operation.
5. Clamp type, four half-inch bolt terminal. One piece jaw contact and terminal pad.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

✓ DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

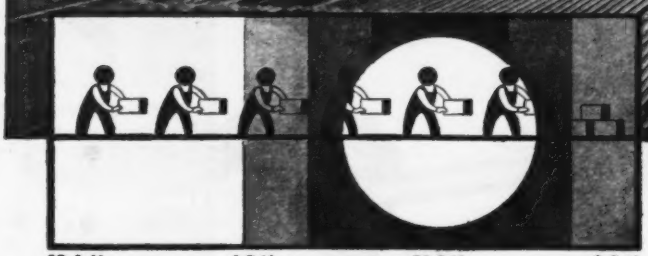
TESTING DEVICES

R&IE
the
SWITCHING EQUIPMENT
Specialist

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
BRANCH IN CANADA — EASTERN POWER DEVICES LIMITED, TORONTO

add daylight hours

TO PRODUCTION FIGURES WITH ENGINEERED FLOODLIGHTING



It's never "after dark" . . . outdoor production levels stay high on all shifts—in yards floodlighted by Westinghouse.

This storage yard is crosslighted from banks of two floodlights each, on 25-foot poles along the sides of the yard. Floodlights used were Type VRC-18, each using 1500-watt lamps. Note the light on the three workmen in right center of the picture.

TYPICAL WESTINGHOUSE FLOODLIGHTS FOR ALL TYPES OF INDUSTRIES

COSTLY slowdowns, accidents and confusion due to darkness can be eliminated effectively . . . profitably . . . by engineered floodlighting. This specialized type of lighting can be applied to most operations normally handled out of doors, to make them equally practical after dark.

Outdoor illumination was pioneered by Westinghouse. Today, Westinghouse furnishes a complete up-to-date line of floodlights, searchlights, street lighting, marine and aviation lighting luminaires—engineered for all applications and use under every climatic condition.

Westinghouse Lighting Engineers can advise as to the most effective methods of utilizing outdoor lighting—whether to furnish light for work alone, or to include protection against peacetime intruders and against saboteurs. This outdoor lighting equipment and engineering experience is available through 117 Westinghouse Electric Supply Company offices, and independent lighting distributors. Contact your nearest Westinghouse Distributor, today. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-04031

Westinghouse *Lighting* **EQUIPMENT**

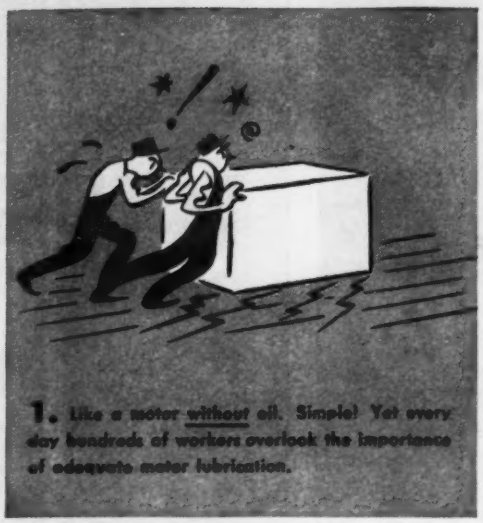
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

AVAILABLE THROUGH 117 WESTINGHOUSE ELECTRIC SUPPLY COMPANY OFFICES AND INDEPENDENT DISTRIBUTORS

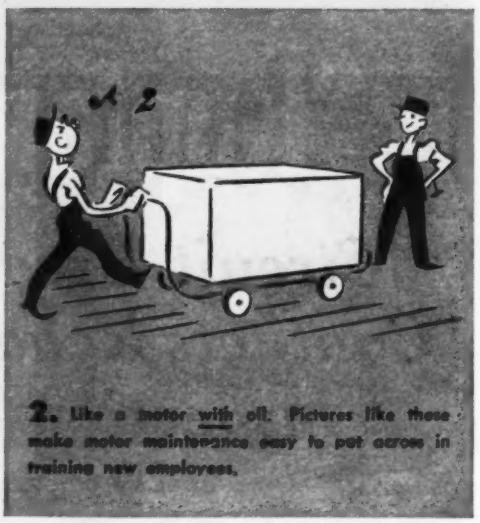
FIGHT FRICTION!

It's Electric Motor Enemy No. 4...

...n Allis-Chalmers' new "Guide to Wartime Care ...f Electric Motors".

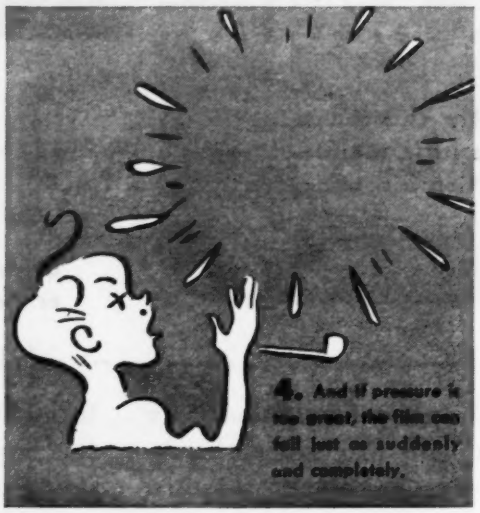


1. Like a motor without oil. Simple! Yet every day hundreds of workers overlook the importance of adequate motor lubrication.

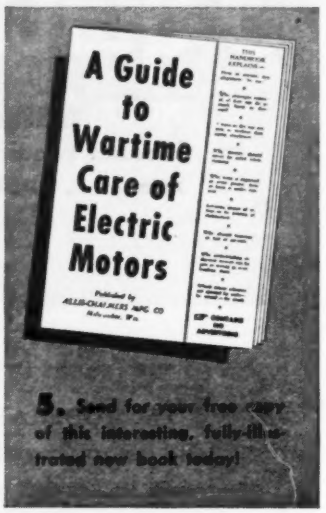


2. Like a motor with oil. Pictures like these make motor maintenance easy to put across in training new employees.

3. Oil film protecting bearings often is no thicker than the wall of a soap bubble.



4. And if pressure is too great, the film can fail just as suddenly and completely.



5. Send for your free copy of this interesting, fully-illustrated new book today!

ONE OF A MOTOR'S most dangerous enemies is friction. In peacetime, instructions for guarding against it were based on 8-hour-day, 6-day-week operation. Today, with motors working up to *3 and 4 times* as many hours a week, those instructions are dangerously obsolete!

To help put U. S. motor maintenance on an efficient wartime footing, Allis-Chalmers has published "Guide to Wartime Care of Electric Motors". This valuable book explains the *9 main enemies* of electric motors . . . tells you how to fight them. Its recommendations are simple and practical . . . ideal for training new men or as a review for experienced men. Book is fully illustrated with stimulating, understandable sketches like those shown above—*contains no advertising*. Over 100,000 copies in use by industry and armed forces. Send for your *free* copy today! ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS.

A 1658

ALLIS-CHALMERS MOTORS

When you do need new motors, look into the strength, solidity and all-around protection of the new "Safety Circle"—protected top, sides, ends and bottom.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

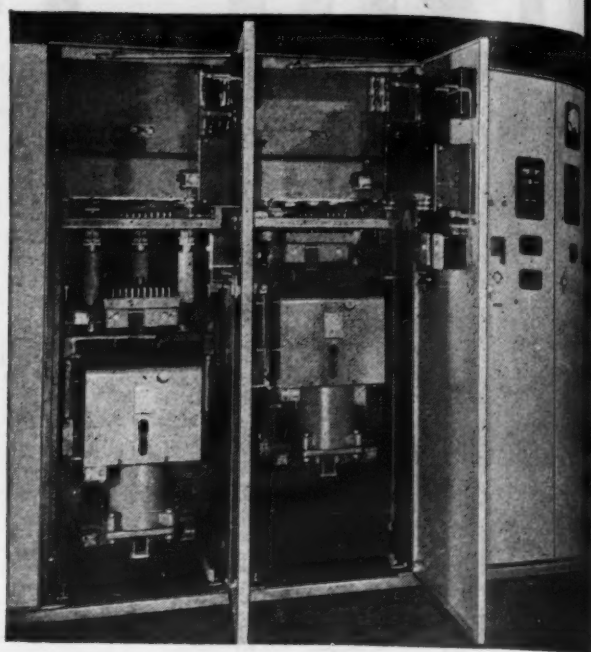
Here's Easy-to-Inspect

"Ruptair"

Circuit Breaker Contacts Ready for Inspection in

3 quick steps

NOTE: Inherently, this oilless breaker requires little maintenance . . . inspection is routine.



1 LOWER BREAKER

Photo shows "Ruptair" magnetic air circuit breaker in normal operating position (at right) and in the lowered disconnect position. The breaker is quickly and easily lowered with a manually or electrically operated crank-hoist.

FOR MODERATE capacity installations, 5 kv and below, the "Ruptair" magnetic air breaker is increasingly popular among operators. Because oil is eliminated from the breaker, fire hazard is reduced, and maintenance requirements are much less . . . particularly for repetitive operation.

In addition to these advantages, and simplest inspection of any magnetic air breaker, the "Ruptair" breaker combines vertical lift construction with horizontal contact separation, illustrated on opposite page.

"Ruptair" breakers are built in standard ratings of 5 kv, 150,000 kva capacity and below.

ALLIS-CHALMERS LETS THE CUSTOMER "HAVE HIS SAY"

You Can Choose From 3 Basic Types of Circuit Breakers

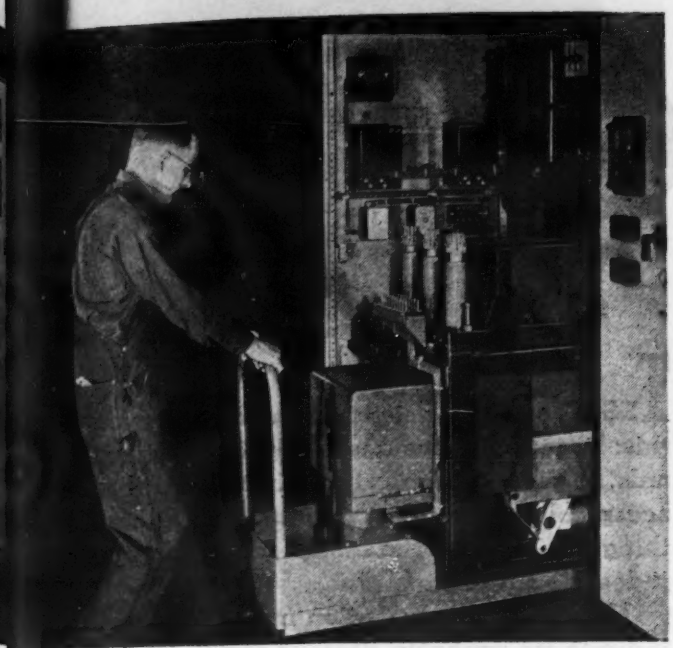
☛Allis-Chalmers wholeheartedly endorses the principle of standardization, wherever the interests of customers are best served. Actually, A-C *introduced* standard metalclad switchgear units to U. S. industry.

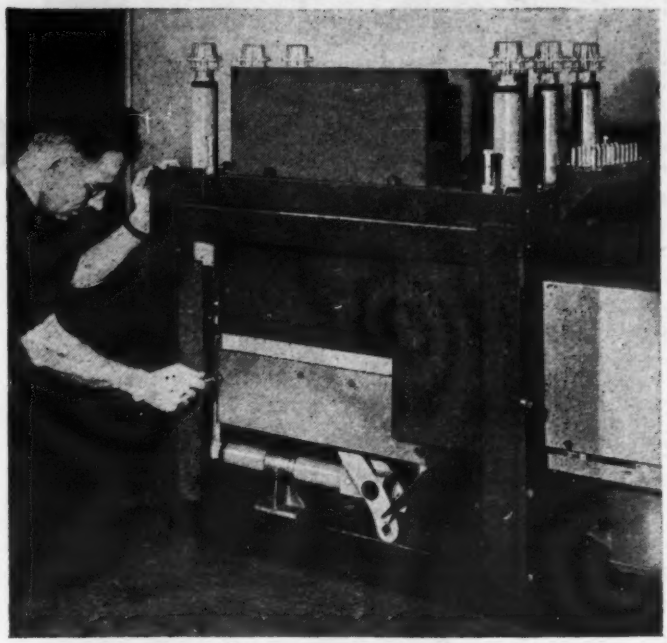
☛What Allis-Chalmers has *not* yet done is to limit *types* of circuit interrupters available in switchgear units. For our A-C engineers believe that the customer rightfully plays an essential part in the development of industrial equipment.

☛Take military aircraft as a parallel case to switchgear. A problem never really solved by the "efficient" German Luftwaffe—that of preparing planes for combat under current combat conditions — was licked by the U. S. Air Forces in a typically American way after Pearl Harbor, when pilot (customer) experience was utilized at Aircraft Modification Centers.

☛In the same way, by offering oil, magnetic air, and air blast breakers for buyer choice, A-C lets the customer "call his own tune" . . . cooperate in the *evolution* of tomorrow's circuit breaker.

Magnetic Air Breaker





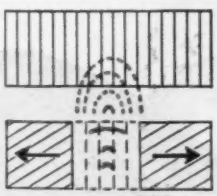
2 WITHDRAW IT

In the disconnect position, the "Ruptair" breaker can be placed on a transfer truck, and pulled out into the aisle. For safety, shutters used to isolate primary disconnect contacts are automatic in their operation.

3 REMOVE SIDE PLATES

Finally, light-weight insulating barriers are removed, each barrier being held in place by two cap-screws. Since the "Ruptair" arc chute is above the contact structure, it need not be disturbed for contact inspection.

"Ruptair" Circuit Breaker Is Engineered For Maximum Interrupting Efficiency

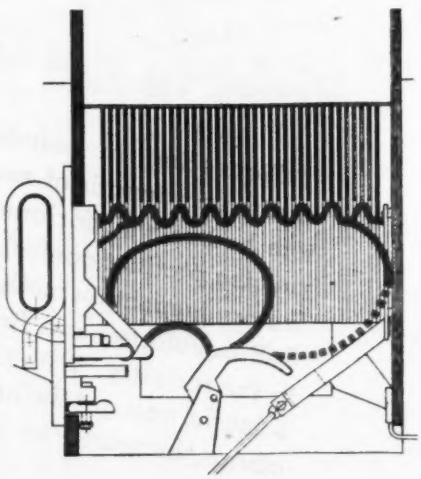


THE "RUPTAIR" breaker depends for efficiency over entire interrupting current range on several design factors . . . one of which is horizontal contact separation.

Since arcing contacts part in the horizontal direction, the arc is assisted into the arc chute by natural thermal effect — no complex interrupting structure is required! In addition, position of arc chute *above* contacts makes it possible to inspect the contacts without removing the chute.

By the coordination of contacts and arc runners, shown in the accompanying diagram, the arc is quickly and easily transferred from the horn-shaped moving contact to the stationary arc runner, opposite.

Another unique feature is the intermediate stationary contact which fully connects the magnetic blowout coil into the circuit before actual contact separation . . . results in augmented blowout effect.



ALLIS CHALMERS

Milwaukee Wisconsin

How Can You Test this Insulator...

TESTS on a *new* station insulator tell you this: It meets dimensional and physical standards. It passes electrical requirements. It has acceptable physical strength. All of these things exist when the insulator is *new*. But it doesn't *stay new!*

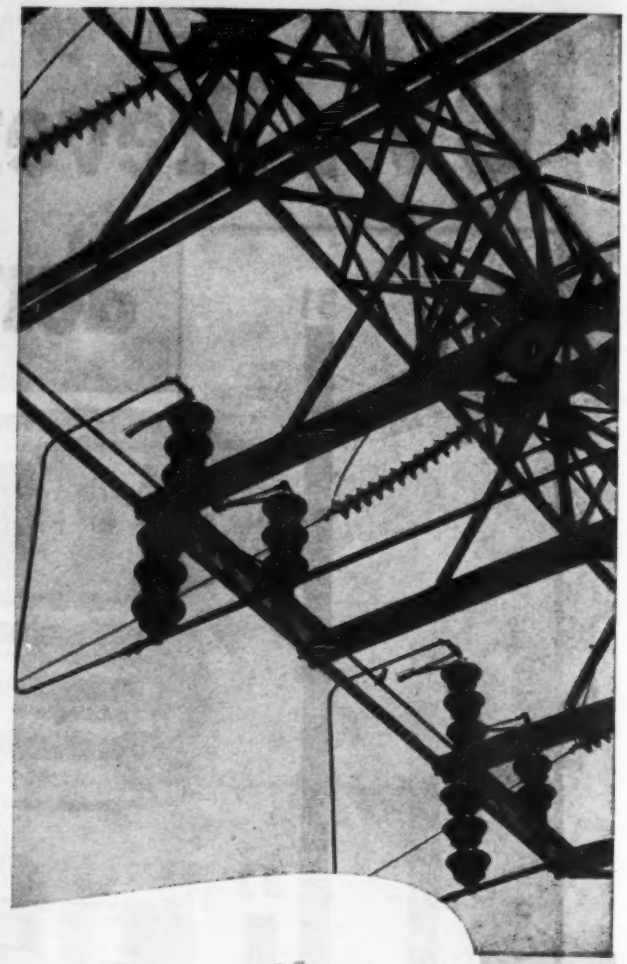
No test on a *new* station insulator will indicate its probable life--its ability to stay on the job without making trouble. You can't devise such a test, simply because you can't reproduce the sequence and variety of oper-

Right to the Windings of Your Apparatus...

Pioneering in branded, guaranteed minimum strength of suspension insulators had to wait for other pioneering in precise product control and enlightened factory inspection methods. Both of these O-B developed and first made available to the industry. With O-B suspension insulators, you get the kind of strength that counts, because you can count on it.

Small size and low cost dare not enter into quality considerations in pintype insulator manufacture. These are the insu-

...TO PROVE THE RELIABILITY OF THIS ONE



ating conditions in a laboratory, plus time.

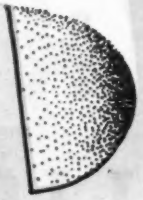
This leaves you two choices in the purchase of station insulators. Buy any kind, put them on the job, and hope that the passage of time will hold no "surprises" for you. Or, specify insulators, many of which have now passed 30 years of active service and which are, themselves, proof of sound design and manufacture.

You can be right 30 years from now if you buy O-B station insulators today!

It's O-B Porcelain Insulation All the Way

lators that bring your product--power--to the ultimate consumer. These are the lines that denote your company in the public eye. Good pintype lines go hand-in-hand with good public relations. Does any insulator have a bigger job? O-B's can measure up to it!

O-B IS THE only bushing with internal porcelain dielectric--porcelain whose absolute ruggedness you know and trust. It's reliable *porcelain* insulation all the way when you use O-B bushings.



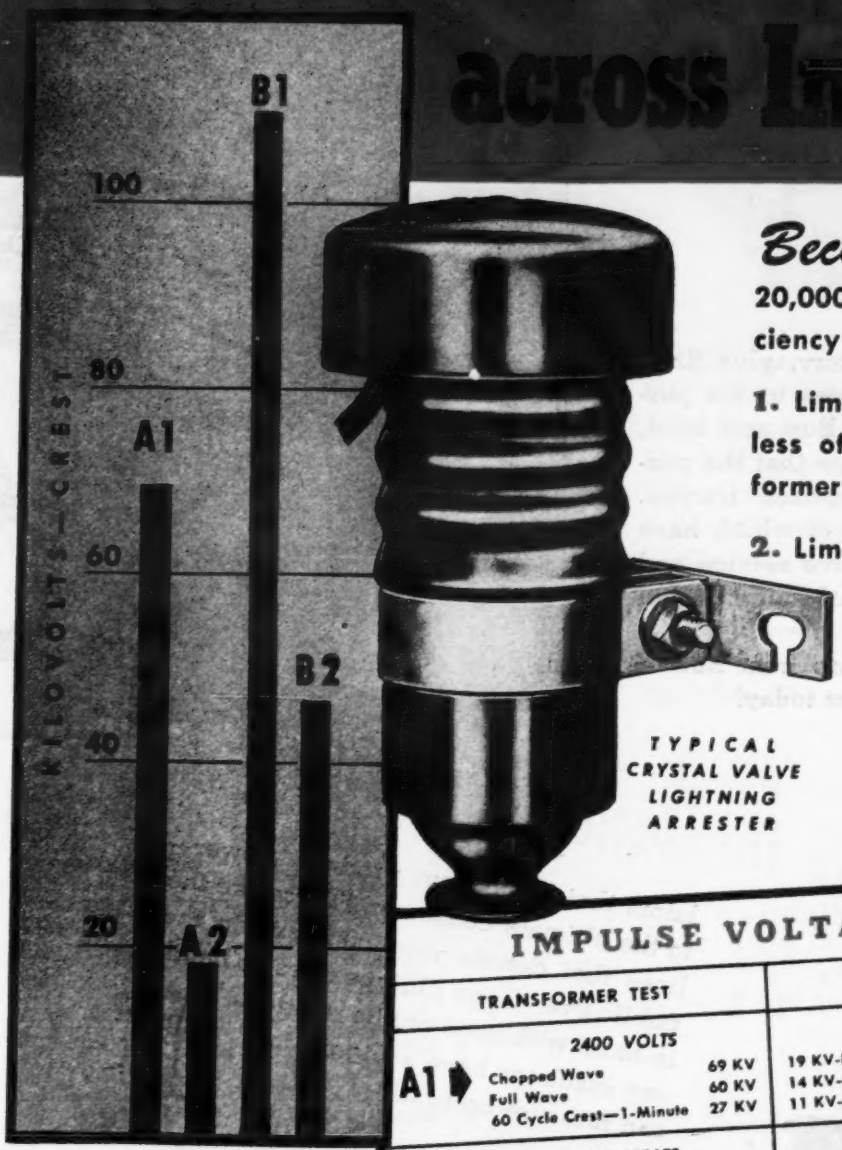
Ohio Brass

MANSFIELD, OHIO, U. S. A.

CANADIAN OHIO BRASS COMPANY, LTD., NIAGARA FALLS, ONTARIO

2603-H

CV's Prevent High Stress across Insulation



TYPICAL CRYSTAL VALVE LIGHTNING ARRESTER

Because **. . . in discharging 20,000 amperes their high efficiency . . .**

1. Limits the voltage to 43% or less of the chopped wave transformer *test voltage*.

2. Limits the voltage to 50% or less of the full wave transformer *test voltage*.

3. Limits the voltage to a value less than the 60 cycle one minute insulation *test voltage*.

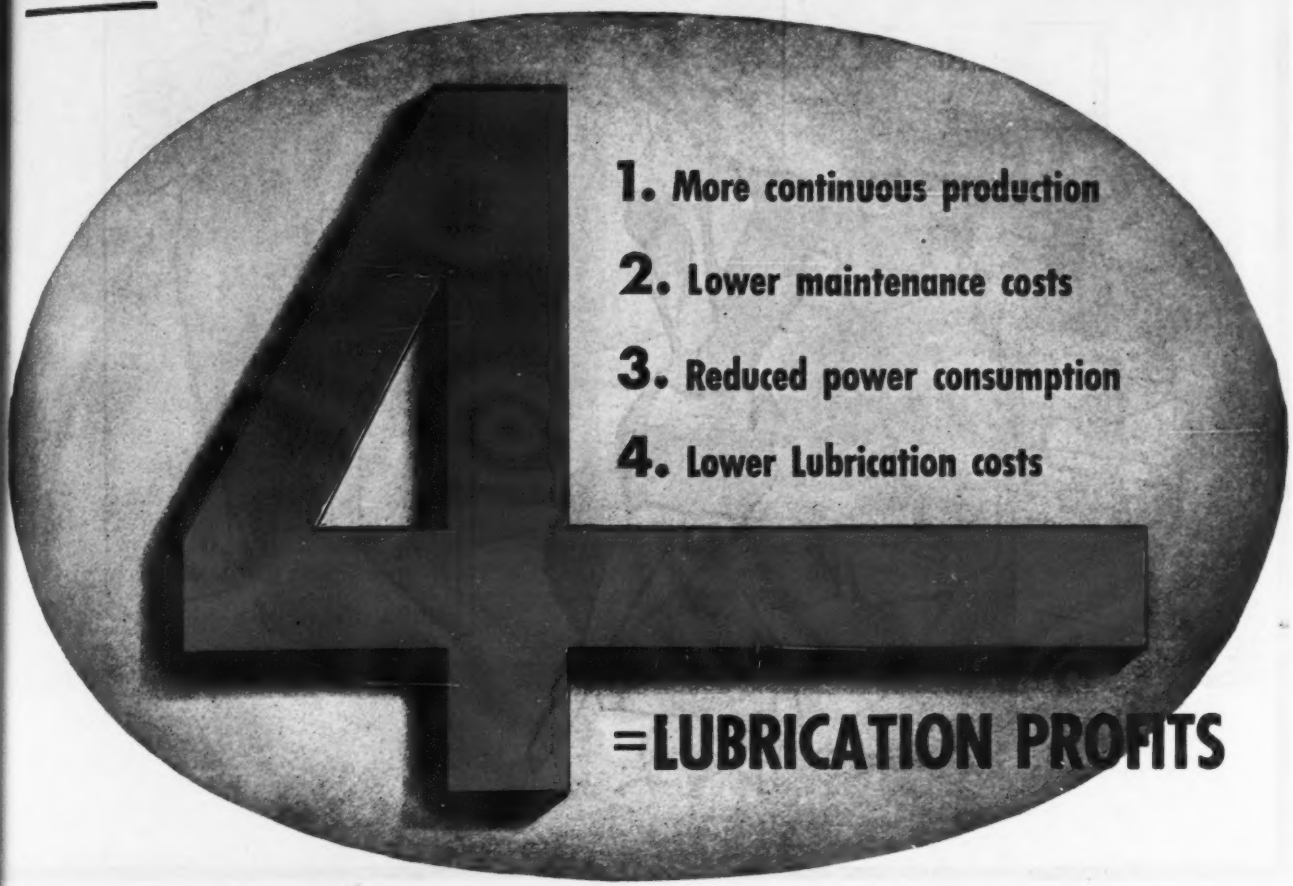
IMPULSE VOLTAGE LEVELS

TRANSFORMER TEST			PERMITTED BY CRYSTAL VALVE	
A1	2400 VOLTS		3000 VOLT RATING	A2
	Chopped Wave	69 KV	19 KV-IR Drop 20000 Amperes 10x20 Wave	
	Full Wave	60 KV	14 KV-Impulse Breakdown	
	60 Cycle Crest—1-Minute	27 KV	11 KV-IR Drop 1500 Amperes 10x20 Wave	
B1	7200 VOLTS		9000 VOLT RATING	B2
	Chopped Wave	110 KV	47 KV-IR Drop 20000 Amperes 10x20 Wave	
	Full Wave	95 KV	43 KV-Impulse Breakdown	
	60 Cycle Crest—1-Minute	48 KV	31 KV-IR Drop 1500 Amperes 10x20 Wave	

ELECTRIC SERVICE MANUFACTURING COMPANY • 17th & CAMBRIA STS., PHILA. 32, PA.

CRYSTAL VALVE
LIGHTNING ARRESTERS

Your 4 Best Oil "Specifications"



Socony-Vacuum's 4-Factor Story

☛ No matter what machines you operate—you'll find that your best specifications for oil or grease are *ultimate results.*

☛ You're not interested in the oil or grease as such. You're after continuous production, uninterrupted by machine failure. You want lower maintenance costs from maximum machine protection, reduced power consumption from lower frictional losses and, finally, you want lower lubrication costs.

☛ In short, what you want are the 4 factors of Socony-Vacuum Correct Lubrication—the 4 factors that add up to lubrication profits for your plant.

☛ You can get these 4 factors now with Socony-Vacuum's *complete lubrication program* for your plant. For this program not only means the best quality lubricants for specific needs, but also includes skilled engineering counsel for scientific application, latest storage and handling methods, charts, controls and even progress reports of benefits obtained.

See your Socony-Vacuum representative and *specify* the 4-factor story for your lubrication dollars.

GARGOYLE Lubricants

Call in **SOCONY-VACUUM** *for Correct Lubrication*

SOCONY-VACUUM OIL COMPANY, INC., Standard Oil of N. Y. Division • White Star Division • Lubrite Division • Chicago Division
White Eagle Division • Wadhams Division • Magnolia Petroleum Company • General Petroleum Corporation of California

He's no more flabbergasted than we'd be . . . if a dried-up roll of Gold Seal Tape showed up!

Jenkins Bros. also make Diamond Seal Friction and Rubber Tapes which meet ASTM and Federal Specifications

NOT A SINGLE THING is left to chance in the production of Jenkins Gold Seal Tape.

Every batch of friction compound is thoroughly lab-tested. Tensile strength of every bale of base cloth is periodically checked. Processing is scientifically controlled every step of the way – right up to the moment when the roll is crisply wrapped in cellophane and tucked in its sturdy red box.

That's why Jenkins Gold Seal Tape doesn't dry out, ravel, or peel like ordinary tape. That's why it sticks to the job instead of the hands . . . why it always reaches you factory-fresh . . . why Gold Seal Tape is your best tape buy. Jenkins Bros., Rubber Div., 80 White Street, New York 13, N. Y.

JENKINS

Jenkins Bros

Gold Seal Tape

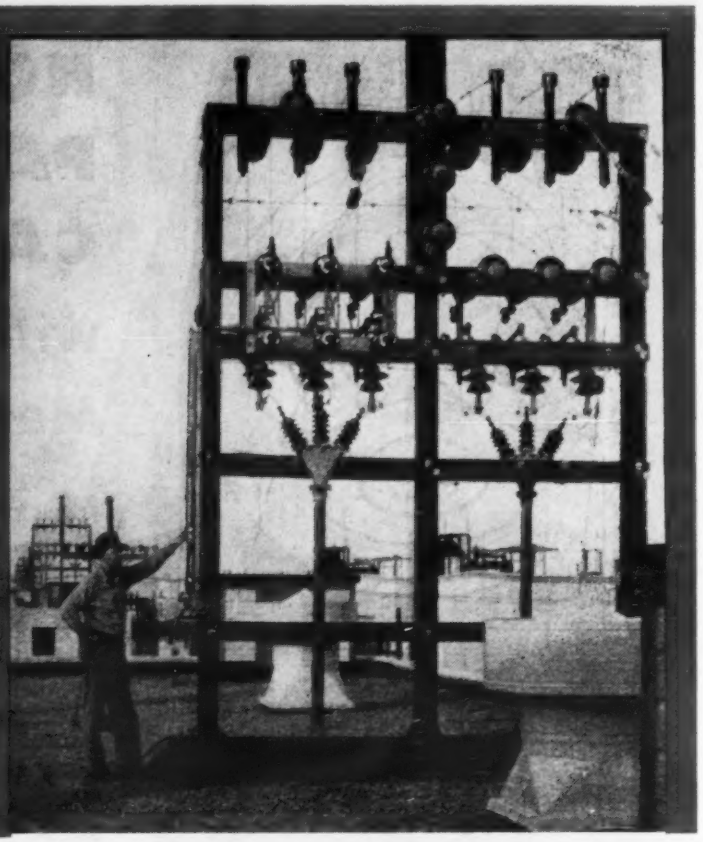
FRICTION and RUBBER TAPES

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

For Modern Load-Switching . . .

LOAD-INTERRUPTER DISCONNECT SWITCHES

Break load without arcing at main switch contacts



Roof-supported, 13.2 kv power circuits on a large synthetic rubber plant, controlled by S&C Load-Interrupter Disconnect Switches.

In America's biggest and most modern plants, where marvels in war-vital work have been wrought, you'll find S&C High Voltage Protective and Switching Equipment installed.

Prominently up front, you'll find S&C Load-Interrupter Disconnect Switches, in wide variety of applications, for modern load-switching . . . proved in times which tried all men, materials and machines.

SCHWEITZER & CONRAD, Inc.
4421 Ravenswood Avenue, Chicago 40, U. S. A.
Represented in Principal Cities (Consult Telephone Directory)
In Canada by Powerlite Devices, Ltd., Toronto, Ont.

Write for Bulletin 202-A

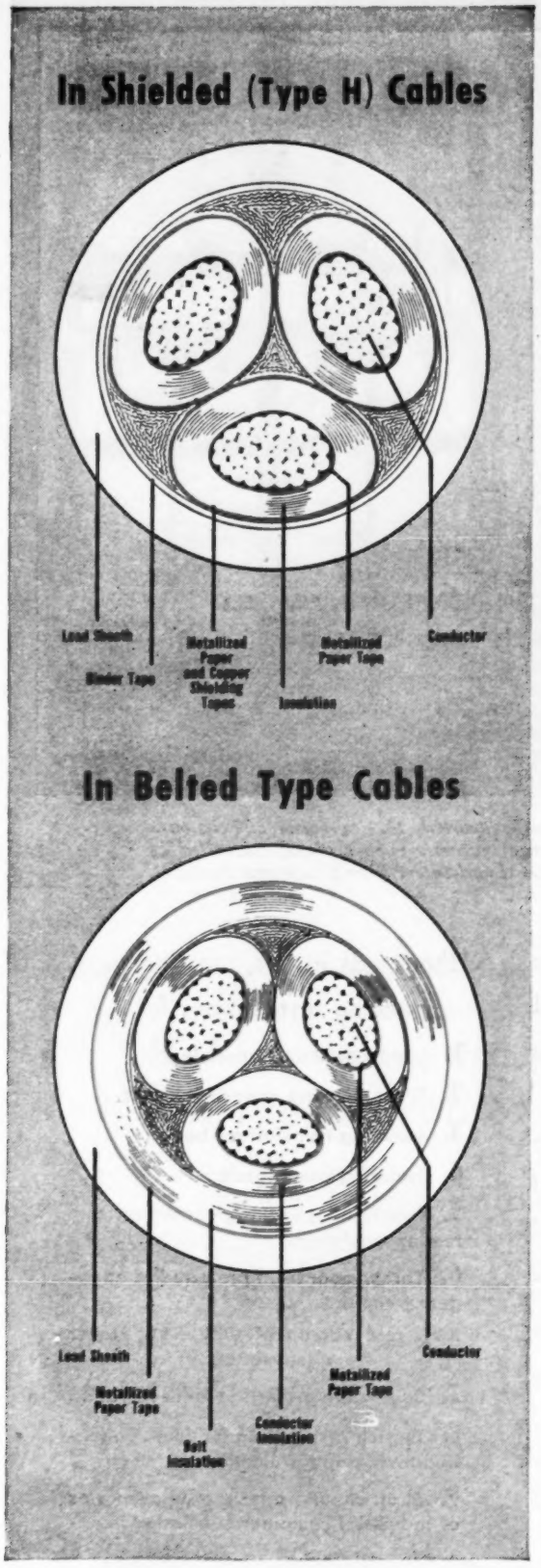
Thousands in Use, reducing costs, speeding installations for . . .

1. Loop circuit sectionalizing.
2. Disconnecting capacitor banks.
3. Isolating transformer banks.
4. Isolating plant feeders.
5. Interrupting exciting current of feeder regulators.
6. Throw-over from preferred to emergency circuits.

. . . and combined with S&C Power Fuses for . . .

7. Substation protection and switching.
8. Branch distributing feeders . . . sectionalizing and protection.
9. Short circuit protection on primaries of industrial customer substations.

LOAD-INTERRUPTER DISCONNECT SWITCHES



HOW TO IMPROVE PAPER INSULATED CABLES

with Keller-Dorian Metallized Paper Tape

HOT COPPER in contact with oil produces certain chemical reactions. In oil-impregnated paper-insulated cables operating at high temperatures, these reactions can hasten deterioration of the paper insulation.

But not if the cable is protected with K-D Metallized Paper Tape. Wrapped over the copper conductor, it sets up a *barrier* between the conductor and the insulation . . . keeps harmful impurities out . . . minimizes the destructive effects of the copper-oil combination . . . and gives your cables longer life.

And because it provides a smooth conductive surface under the insulation there are no concentrated points of electrical stress.

Ionization—caused by expansion of the lead sheath away from the insulation—is minimized. For K-D Metallized Paper Tape, wrapped over the insulation, keeps contact with it . . . short-circuits the space created . . . increases the dielectric strength.

Whether it's a belted or shielded type of cable . . . this tape will provide a lower power factor . . . greater breakdown values . . . increased safety factor . . . retarded thermal aging of the impregnated paper. Insure these advantages next time you order electrical wires and cables from your manufacturer. Specify them with Keller-Dorian Metallized Paper Tape protection. Keller-Dorian Corporation, Empire State Building, New York 1, N.Y.

KELLER-DORIAN

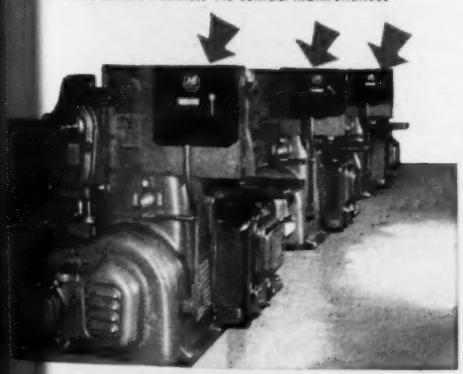
CORPORATION

EMPIRE STATE BUILDING, NEW YORK 1, N. Y.

METALLIZED PAPER TAPES FOR ELECTRICAL WIRES AND CABLES

Where Continuous Production is Vital
...you'll find Allen-Bradley Combination Starters

Gardner grinders equipped with Allen-Bradley Bulletin 712 Combination Starters. Silver alloy contacts—even on the A-B disconnect switch—eliminate contact troubles. No contact maintenance.



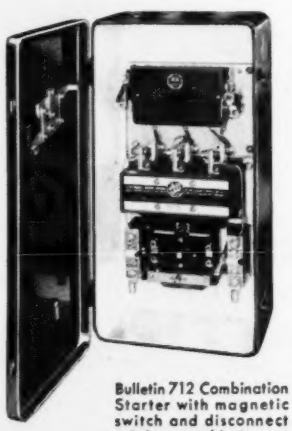
A row of Cincinnati Milling Machine Company's "Hydromatics," equipped with Allen-Bradley Bulletin 712 Combination Starters. Available with line fuses. Bulletin 713 starters have circuit breakers.

This war-effort production line cannot tolerate interruptions. Motor control failures cannot be allowed.

There are no control failures . . . no contact troubles . . . no starter maintenance in this plant . . . because row after row of machine tools is equipped with Allen-Bradley Combination Starters. Simple in design . . . quality construction . . . dependable performance . . . these are the reasons why A-B Solenoid Starters are specified where continuous production is vital.

Send for "The Story of the Solenoid Starter," and get the inside facts about trouble-free control for a-c motors.

Allen-Bradley Company
1316 S. Second St., Milwaukee 4, Wis.



Bulletin 712 Combination Starter with magnetic switch and disconnect unit in one cabinet.

A-B

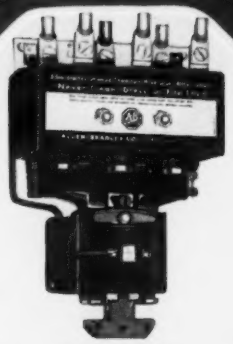
ALLEN-BRADLEY

BULLETIN 712-713 COMBINATION STARTERS

QUALITY

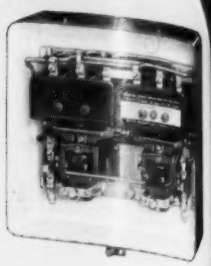
THE ALLEN-BRADLEY LINE OF SOLENOID STARTERS

SIMPLE DESIGN • SILVER ALLOY CONTACTS • TROUBLE-FREE OPERATION

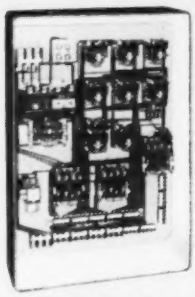


Bulletin 702
Solenoid Contactor

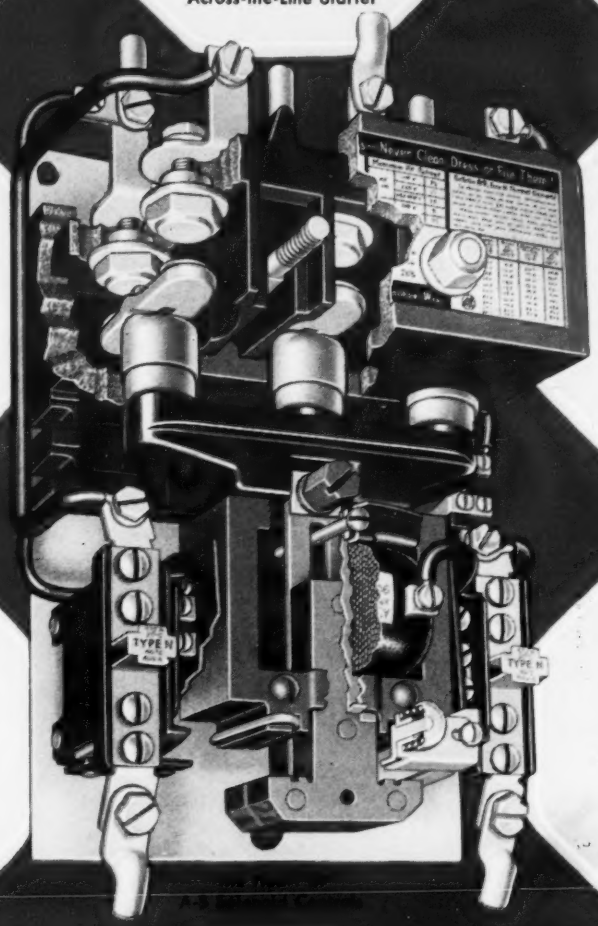
Bulletin 709
Across-the-Line Starter

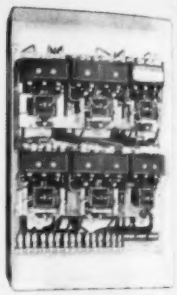


Bulletin 705
Reversing Switch

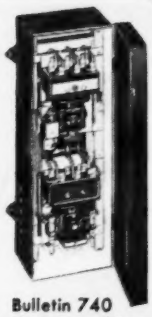


Special Panels
for Machine Tools

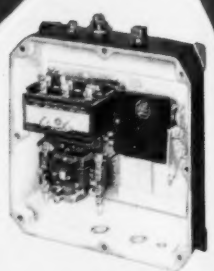




Bulletin 715
Multi-Speed Starter



Bulletin 740
Auto. Resistance Starter
Velvet-Smooth Acceleration



Bulletin 712
Combination Starter
in Watertight Enclosure

The design of Allen-Bradley controls follows a uniform pattern throughout the entire line. The basic unit is the standard A-B solenoid switch, available in six sizes and a maximum rating of 150 amperes. All have only one moving part. All have silver alloy contacts. There is no contact maintenance. Such standardization and simplicity guarantee trouble-free performance. That is the experience of all users of Allen-Bradley solenoid motor controls.

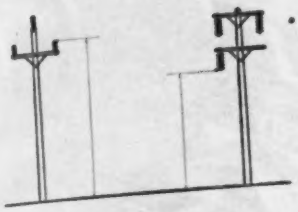
MOTOR CONTROLS FOR ALL INDUSTRIES

A-B Quality

ALLEN-BRADLEY

QUALITY

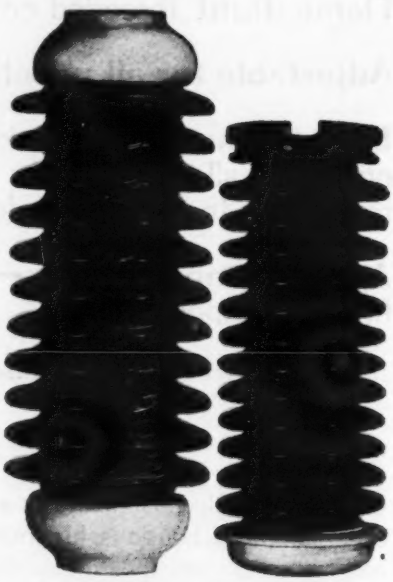
LINE POST CONSTRUCTION IS ECONOMICAL FOR CONVERSION TO HIGHER VOLTAGES *OR* NEW BUILDING



Any still-sound transmission line can be converted to higher voltage at low expense—and economically of manpower—by reinsulation on Line Posts. Ordinarily only new cross-arms and insulators are needed, and the job can be done with hot-line tools or during low-demand hours. For new construction, Line Posts offer substantial advantages in cost and operating performances. Because of the Line Post's upright height, it provides extra ground clearance —or in some cases the opportunity to use poles of the next shorter length.

LAPP LINE POSTS ARE LONG-LIVED... ALL HARDWARE EXTERNALLY ATTACHED

A feature of the Line Post in the original Lapp design was the *external attachment of all hardware,* and the elimination of nested porcelain parts. An inherent characteristic of porcelain is that it is at least ten times as strong in compression as in tension. Much of the failure from cracking in conventional insulators comes from bursting tension forces induced by thermal change. Lapp considers that its original conception was sound, and offers Line Post and Station Post insulators with all hardware externally attached—and still claims "*no cracking*" as a feature of these units.



Lapp

LAPP INSULATOR COMPANY, INC., LE ROY, N. Y.

Type EGP — a whole series of

Explosion-Proof

CONDULETS

designed especially for panelboard mounting — exclusive with CROUSE-HINDS

Type EGP Combination Push Button Station and Pilot Light Condulet. Installed on Panelboard. Broken-away view.

Switches and pilot lights — single or in combinations.

Factory sealed — installation seals unnecessary.

Flame-tight threaded covers.

Adjustable for all panels — ⅛" to 1-¼" thick.

Easy to install in quickly drilled circular panel openings, all of the same size. Switches may be rotated up to 10 degrees for alignment.

Attractive appearance — dead black instrument finish on exposed parts.

Listed in Condulet Catalog No. 2500, Section 85, Page 26-AA1

Crouse-Hinds also manufactures a complete line of explosion-proof housings for instruments, gauges and meters for panelboard mounting.

A Nationwide Distribution Through Electrical Wholesalers

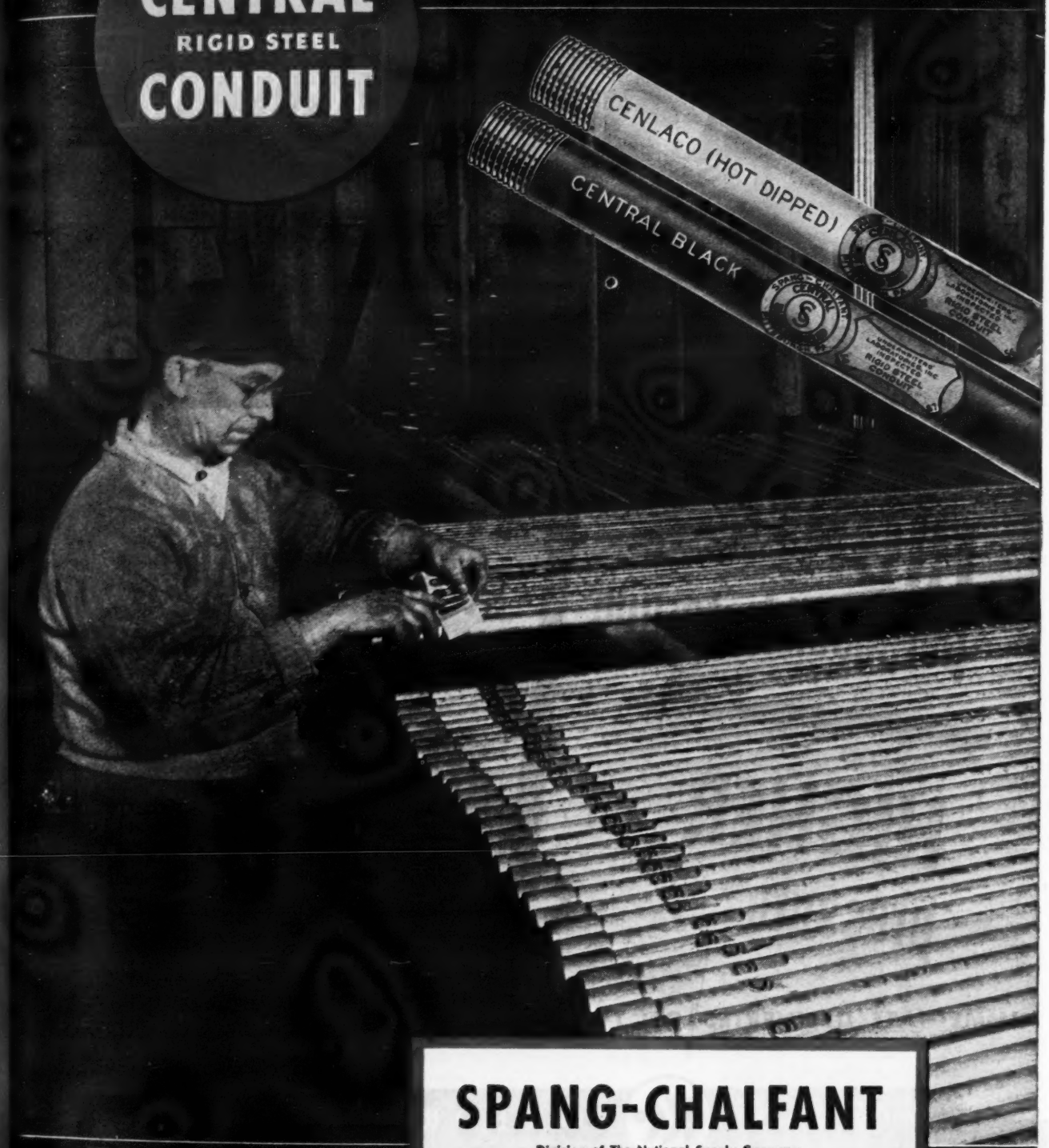
CROUSE-HINDS COMPANY
Syracuse 1, N. Y., U.S.A.

Offices: Birmingham — Boston — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington
Resident Product Engineers: Albany — Atlanta — Charlotte — New Orleans
CROUSE-HINDS COMPANY OF CANADA, LTD., Main Office and Plant: TORONTO, ONT.

ULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

Final Assurance

that **CENTRAL** RIGID STEEL **CONDUIT** is the finest you can buy



"There's Tested Strength in Every Length"

SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

LINE MATERIAL SOLDERLESS

Electrical Connectors

HIGHER permissible torque

HIGH strength factor

HIGHER pressure . . . . .

BETTER electrical connection

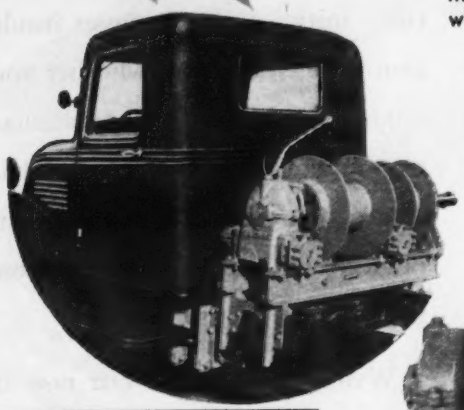
IMMEDIATE DELIVERIES ON TYPES AND SIZES FOR EVERY REQUIREMENT

MADE BY KYLE CORPORATION SOUTH MILWAUKEE WISCONSIN

HIGHWAY DOUBLE DRUM WINCHES

FOR USE WITH TYPE T-45 POLE DERRICK

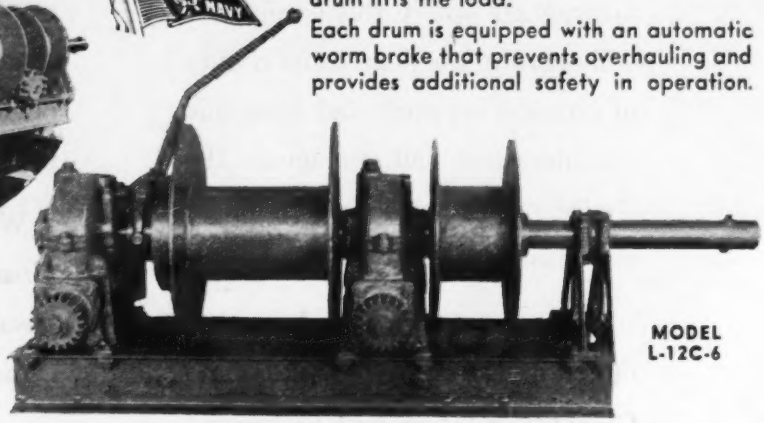
CONTROLS LOAD LINE AND BOOM LINE..



The Model L-12C double drum winch has all the advantages of the single drum winch as well as having an extra drum for auxiliary purposes. Each drum operates independently of the other. The large drum is provided with a positive spline type clutch and can be used as a free spool for pulling cable off manually. The small drum is of the fixed type and operates only when power is applied.

When used with the T-45 pole derrick the line from the small drum is attached to the derrick head and controls the position of the derrick. The line from the large drum lifts the load.

Each drum is equipped with an automatic worm brake that prevents overhauling and provides additional safety in operation.



MODEL L-12C-6

SPECIFICATIONS

Length of large drum	12"
Length of small drum	8"
Diameter of each drum	8"
Diameter flanges—large drum	19"
small drum	16"
Cable Capacity—large drum (7/16" cable)	800'
small drum (7/16" cable)	200'
Pulling capacity each drum	10,000 lbs.
Weight	710 lbs.

TYPE P-2-LL

(Drives Both Drums)

★

DUAL DRIVE POWER TAKE-OFF

FOR USE WITH DOUBLE DRUM WINCHES

The Type P-2-LL power take off is a dual purpose unit that mounts in the drive shaft line of the truck directly behind the transmission and is equipped with two output shafts for driving double drum winches or one winch and air compressor or any two devices requiring separate drives. All of the speeds of the truck transmission may be used for either drive and in either the forward or the reverse direction. This permits exceptionally slow speeds for heavy loads and high speeds for lighter work.

The housing of the Type P-2-LL power type take off is made of electric steel and the gears of chrome nickel steel carefully heat-treated. All shafts and gears are mounted on anti-friction bearings.

Highway propeller shaft power take offs deliver the full power of the engine to the winch.

INSTALLATION OF P-2-LL POWER TAKE-OFF

HIGHWAY TRAILER COMPANY

MANUFACTURERS OF

TRUCK TRAILERS AND BODIES • EARTH BORING MACHINES • WINCHES • OTHER PUBLIC UTILITY EQUIPMENT

General Offices

EDGERTON, WIS., U. S. A.

INSULATION PLANNING

Belongs at the early stages of the product

THE load characteristics of electrical apparatus; the presence of dirt, moisture and chemicals in the atmosphere where this equipment will operate; the degree and nature of physical support; and economic considerations all influence the choice of insulating materials in electrical equipment design.

As a manufacturer and supplier of Class O, Class A, Class B, and Class C insulation, with fifty years' experience in the field of electrical insulation, the Mica Insulator Company can help you with your insulating problems.

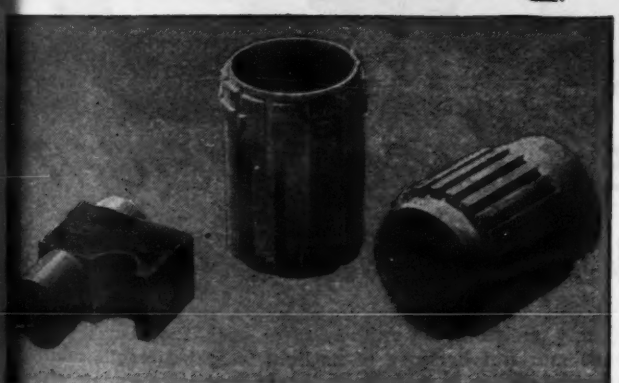
Consult Mica Insulator Company's engineering staff as a practical, initial step whenever insulation problems arise—whether your application be electrical appliances, components of heavy industrial electrical equipment or electronic devices for industrial and communication equipment.

Write for copy of our new informative handbook, "Electrical Insulating Materials," on your company letterhead.

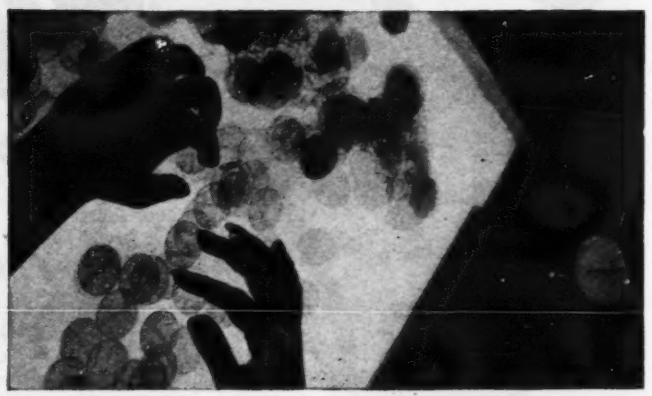
Motor-generator built by Star Electric Motor Company depends upon Fiberglas and Mica, Lamicoid (Laminated) Fiberglas and untreated Fiberglas insulation. These materials provide a safety factor for elevated temperatures, high humidity and heavy overloads.

MICA

design picture!



Electrical components requiring close tolerances and intricate design are readily fabricated from Lamicoid. From the wide range of resins, fabrics and papers, you can obtain Lamicoid having the exact electrical and mechanical properties that you require.



The proper selection of mica for any particular purpose is a task that requires long experience and a sound knowledge of the properties of mica in all of its various types and grades. Call our staff engineers about your specific problem.

SALES OFFICES:

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FACTORY:
SCHENECTADY, NEW YORK

Insulator **COMPANY** 200 Varick Street New York 14, N. Y.

HERE'S LIGHT WEIGHT AND STABILITY...

FOR many mechanical and structural uses, Formica is the chosen material because of its light weight, strength, and a remarkable ability to remain unchanged under a variety of conditions.

Moisture absorption is low, and that contributes to great dimensional stability under varied conditions of humidity. The coefficient of thermal expansion is also very much lower than that of metals and that also tends to hold the original dimensions. The material possesses a high degree of chemical inertness which prevents corrosion and maintains the surface finish under a wide range of conditions.

In wearing parts the material has a tendency to wear smoothly without accumulating a corrugated surface, and that contributes to long life.

Formica engineers have a wealth of information in detail regarding these qualities which they would be glad to pass on to those interested.

FORMICA

THE FORMICA INSULATION CO., 4630 SPRING GROVE AVE., CINCINNATI 32, O.

The Way YOU USE IT determines how we design it

L-M Pole Line Hardware... designed to fit the user's requirements

There's no fooling about designing pole line hardware at Line Material. It must meet one major requirement: *what does the user want it to do?* L-M believes in this—and L-M users will confirm this. Take as an example just ordinary nuts and bolts. The lineman wants 'em to go on easy, and stay put. Threads must be loose enough for nuts to spin on, but tight enough so they don't vibrate off. Clamps must stand plenty of tension without any more weight than necessary. Get the facts, figures, details—from the L-M Field Engineer—or write Line Material Co., Milwaukee 1, Wis.

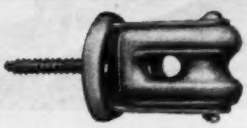
. . . designed the way you want it
. . . built to last a long time
. . . packed for convenience
. . . right in all ways

With a Potato and a Jackknife

You know the old L-M legend—and it's true, too—how, years ago, a customer asked an L-M man for a certain piece of hardware that nobody had made. The L-M man whittled it out of a raw potato with a jackknife, the customer OK'd it then and there—and L-M made it—and has made it ever since! We're still doing it—making hardware the way the customer wants it. Every once in a while a new item comes out—and practically always because customers wanted it built that way. That's typical of L-M service.

A Few Standard Items—L-M makes a complete line of standard items—hardware that's almost universally used. But we try to make it just a little better.

Wireholder
No. 3-3-3



Just jab it and twist it in! Sharp-pointed wood screw with keen-edged full-length thread, firmly anchored in plenty-tough porcelain. Reinforcing steel yoke gives unusually high mechanical strength. Also with loose screw, stud or toggle bolt.

Weldsteel Secondary Rack
No. 23038

One of the most popular types. No. 9-gauge pressed steel; insulator supports arc-welded to full depth of channel—extra strength for heavy service. Others for 2, 3, or 4 wires, from 4 to 12 inch spacing; 9 to 32 inches long.

Steel Insulator Pins
No. 30026

Special forged steel; ¾-inch straight shaft, 2½-inch base; 6-inch shank for wood cross arms; also with 1½-inch shank for steel arms. Choice of 1 or 1⅜-inch Allen lead heads. Galvanized.

A Few L-M Specialties—L-M has designed many line construction specialties to solve problems for certain users or certain parts of the country. Perhaps there's something here for you.

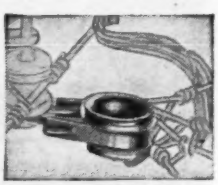
Strain Clamp
No. 907

Forged steel, hot-dip galvanized. Light in weight, but exceptionally strong, with high tensile strength. Reversible tongue with grooves of different depths on each side gives proper contact with sizes from No. 6 solid to No. 4/0 stranded.

Universal Guy Clip
No. CL-117X

Forged steel; rounded corners prevent injury to wire. Opposed bolts permit full 360° turn of wrench. Long non-slip grooves; large gripping area. Five sizes for ¼ to ½-inch guy wire.

Take-Off Insulator
No. A-260010-1



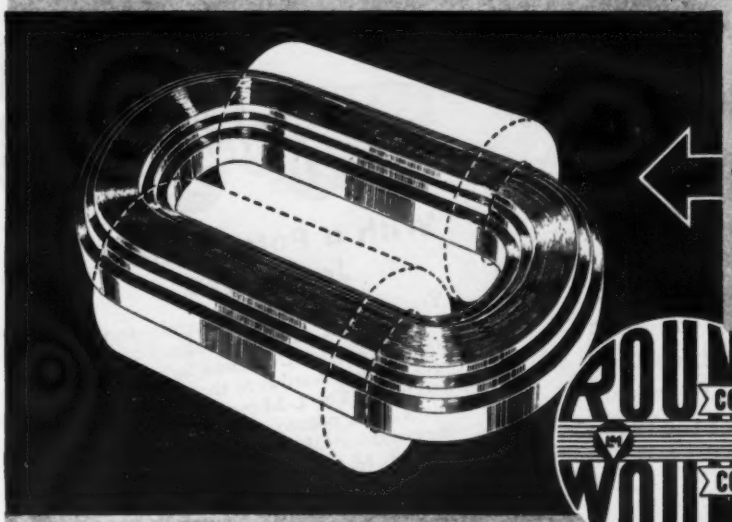
Efficient, economical for handling multiple service drops. Eliminates overloaded rack spools and tangled connections; simplifies adding or removing drops. Steel yoke snaps into slots in insulator band, permits attaching yoke first. For secondary rack or pole mounting.

LINE MATERIAL
POLE LINE HARDWARE

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

What every utility about L-M ROUND-WOUND

How they're designed



THE WOUND CORE

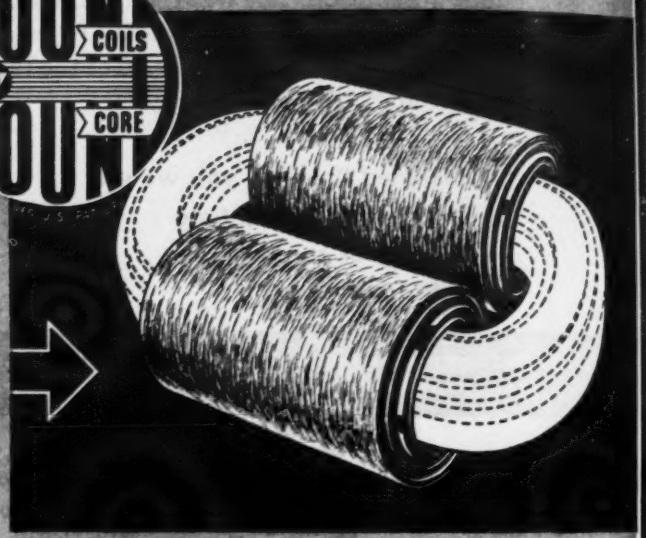
Core wound under tension, "with the grain," in elliptical shape closely approaching perfect magnetic flux movement.

Practically no air gaps—reduces exciting current substantially.

Core not relaminated, rewound, or cut in section after annealing. Result: stable characteristics.

Cruciform cross section permits free and easy circulation of cooling oil, giving low temperatures.

ROUND COILS IN WOUND CORE



THE ROUND COILS

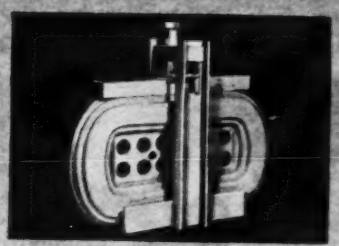
Coils are wound directly onto core, eliminating all necessity for disturbing core after it has been formed and annealed.

No air spaces between layers; correct ratio of coil length to thickness; reduces leakage flux, results in low reactance.

Further cooling is provided by oil duct spacers wound into the coil during winding. Prevents hot spots in the coil.

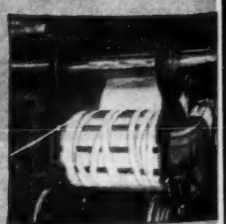
How Wound Core and Round Coils Are Made

Silicon-steel strip of varying width is wound under tension in this machine. The result: a wound core with no air gaps; practically ideal core shape.



Core is not cut or unwound after annealing: assures stable characteristics; freedom from stresses; lower leakage flux; better ratio of losses.

Geared split flanges are placed around the taped core legs, which act as a shaft upon which winding machine revolves flanges (which are removed later).



Coils are wound on pap tube winding form whi insulates coil from cor Even tension prevents a spaces, decreases resistanc lowers reactance.

LM

LINE MATERIAL

TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

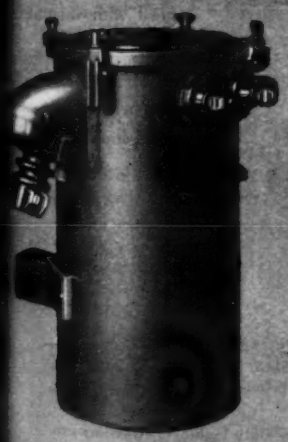
man should know Transformers

How they perform

- **INCREASED REVENUE . . .**
  Because they give improved regulation at all power factors, L-M Round-Wound transformers deliver increased voltage to your customer. Thus they increase your operating revenue, and also your rate of profit per kilowatt-hour.

- **LOWER COSTS . . .**
  Because they have a better loss ratio—lower copper loss in relation to core loss—L-M Round-Wound transformers operate more economically. Improved time-temperature characteristics and higher short time overload capacity give longer transformer life, lower replacement cost. Uniformly high impulse strength decreases the chances of failure caused by lightning, another reason for lower operating cost.

- **BETTER CUSTOMER RELATIONS . . .**
  Better regulation means fewer low-voltage complaints from customers. Lower reactance cuts flicker, reduces complaints. Fewer failures caused by lightning and overloads mean fewer service interruptions. These help improve your relations with your customers.



Meet latest EEI and NEMA standards. L-M Round-Wound transformers are built in complete accordance with EEI-NEMA standards. Hangers, bushings, terminals and accessories are regular NEMA standard specifications.

Ratings. L-M Round-Wound transformers are available in 1½ to 25 Kva, 2400 to 7620 volts.

Other types. Line Material offers many types of transformers: single and three-phase, "3-I" (protected), dry type, subway, rural, and conventional type distribution transformers up to 500 Kva. For information write for bulletins on the type you require.

It will pay you to investigate the characteristics of Round-Wound construction. The ideal core shape without air gaps; and long, evenly wound coils with no air spaces between layers permit fewer turns in coils without sacrificing low exciting current.

The round coils, with generous, undisturbed insulation and exceptional cooling, aid in assuring uniformly high impulse strength, greater protection against lightning hazards, and greater capacity for short-time overloads.

These are some of the reasons why it will pay to standardize on L-M Round-Wound distribution transformers, now, and for your new construction.

Here is Why:

1. Improved regulation at all power factors.
2. Better ratio of losses.
3. Uniformly low exciting current.
4. Uniformly high impulse strength.
5. Higher short-time overload capacity.

GET THIS FREE BULLETIN

Ask the L-M Field Engineer for a copy of Bulletin RW-421 which gives a good deal of information on Round-Wound design and construction, and features such as tanks, bushings, tap changers, hangers, and mountings and accessories, lists ratings of L-M transformers available. Call or write the nearest L-M branch for a copy, or write Line Material Co., Transformer Division, Zanesville, Ohio.

LM

LINE MATERIAL
TRANSFORMERS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters • Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

Why L-M Heavy Duty LIGHTNING ARRESTERS give such long, unfailing protection

Years of service do not change the unfailing protection afforded by L-M Heavy Duty Lightning Arresters. A high degree of protection is designed and built into these arresters, with high discharge capacity, exceptional stability of the characteristic element, and double sealing against moisture.

Hundreds of thousands are in successful service, with an almost infinitesimal percentage of transformers or arresters reported damaged by lightning. If you are not getting this service, you can cut arrester costs by standardizing on L-M Heavy Duty Lightning Arresters. Ask the L-M Field Engineer who calls on you; or call or write the nearest branch office, or Line Material Company, Milwaukee 1, Wisconsin.

Handles Heavy Surges Easily

Instant Response: The electrically fast ladder gap goes into action early, before the surge can build up to a dangerous value. The gap is a precision device, with quick response to steep wave fronts.

Low IR Drop: On a 10,000-ampere surge, IR drop is only 16.9 Kv; and is but slightly higher on much greater surges. This assures protection to the transformer with a large safety factor.

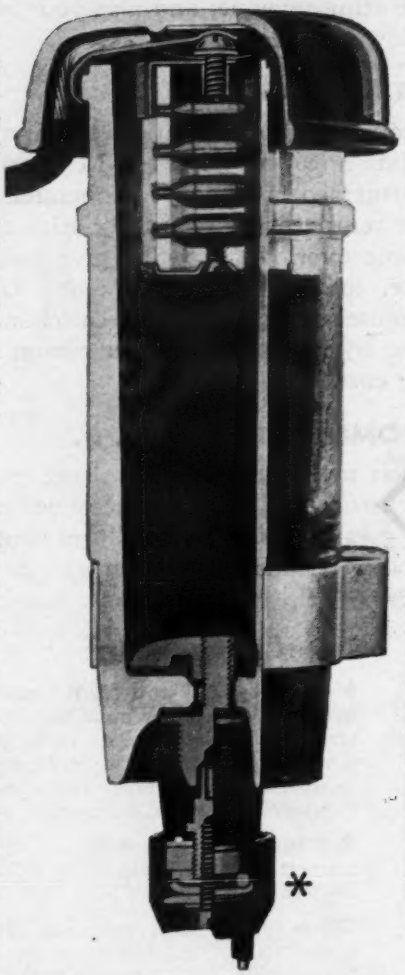
High Discharge Capacity: L-M Heavy Duty Lightning Arresters handle, without damage, the 65,000-ampere surge specified in NEMA and AIEE standards, showing their high discharge capacity.

Handles Them for a Long, Long Time

High Stability: The characteristic element is electrically and chemically stable, and permanently retains its high discharge capacity and resistance to follow current.

Double Sealing Against Moisture: Top and bottom of the arrester housing are sealed by long-life synthetic rubber gaskets, compressed against the glass. In addition, a weather-resisting compound *seals the seals.*

Heavy Duty Construction: The arrester is built for heavy duty throughout. An example is the precision ladder gap, with electrodes of solid brass bar machined to size, exactly spaced and held in position by steatite insulators. Its electrical characteristics are unaffected by discharges.



Upper Moisture Seal—long-life synthetic rubber gasket, double-sealed with weather-resisting compound.

Precision ladder gap—goes into action fast; electrical characteristics not affected by discharges.

Characteristic element in form of a solid block molded into the Pyrex* glass (or porcelain) housing; is absolutely stable.

*Reg. trade mark

Lower synthetic rubber moisture seals; double-sealed with weather-resisting compound.

Mechanically strong solderless connector for ground lead.

*"The Isolator"—an exclusive L-M feature under Pat. 2,315,300.

Meet New NEMA Standards. All L-M Heavy Duty Lightning Arresters meet the new NEMA standards. In repeated tests, these L-M Arresters maintain uniform performance characteristics.

Made in Six Sizes. L-M Heavy Duty Lightning Arresters are made in 6 sizes with ratings from 1 to 15 Kv.

LM

LINE MATERIAL
LIGHTNING ARRESTERS

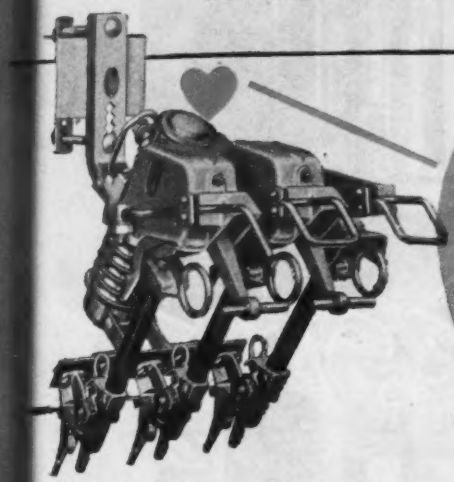
L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers • Fuse Cutouts and Fuse Links • Lightning Arresters
Oil Switches • Pole Line Hardware • Line Construction Specialties • Underground Equipment • Fibre Conduit • Street Lighting Equipment

CUT Distribution Outages 48 to 61%*

with L-M Reclosing Fuse Cutouts

L-M Reclosing Fuse Cutouts consist of two or three single-shot fuse cutouts, so connected that when a fuse link blows, the next fuse link is automatically put into the circuit. A hydraulic bellows mechanism provides a short time-delay for the fault to clear. L-M Reclosers are simple: no mechanism to cock or reset, nothing the lineman must remember. Cartridges can be replaced in any order, without interruption of service. Extensive tests have shown that a two-shot recloser eliminates 48% of all outages, a three-shot 61%.* Thus reclosers are a most effective and economical means of maintaining uninterrupted service and reducing special service trips.

*Percentages based on reported utility experience



Type RLO
brush type contacts
3000, 7500/12,500 and 15,000 volts; 100 amps.

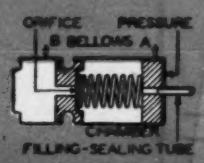
A link blows, cartridge drops to open, indicating position, actuating time-delay mechanism and switching-in the next link. Impossible to have two fuses in parallel. Available as either two or three-shot recloser.

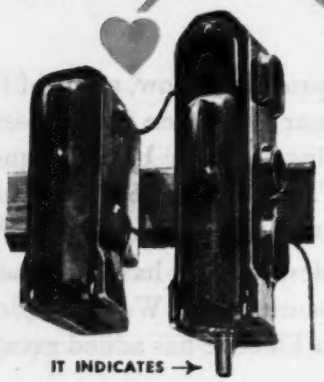
Type RP-515
Reclosing Unit
5000 volts △; 100 amperes

Connect this unit to any single-shot cutout now on your line to make a two-shot recloser. Two RP-515's make it a three-shot recloser. Same time-delay mechanism; same indicating feature of drop-out cartridge, easily seen from the ground. Door stays closed, protecting parts from weather.

HYDRAULIC TIME-DELAY... HEART OF L-M RECLOSERS

Hydraulic bellows mechanism is actuated whenever a fuse link blows and cartridge drops. After a short time-delay, it switches in the next fuse cutout. Fully automatic; not affected by weather or temperature. Adjustable from ½ to 1 second.





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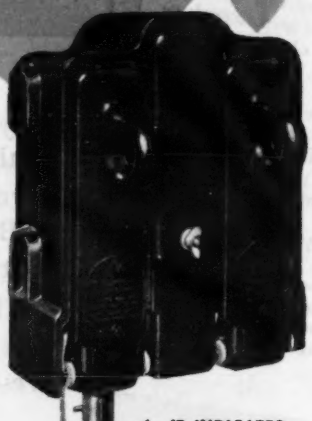
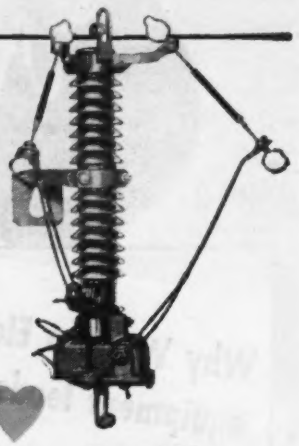


← IT INDICATES

GET THIS RECLOSER FOLDER

"Where L-M Reclosers Pay, and Why." For Fuse Cutout details and specifications, get Bulletin 44-101. Ask the L-M Field Engineer; or write Line Material Co., Milwaukee 1, Wis.



Type RTF
Tubeless Two-Shot Recloser
7500/12,500, and 15,000 volts; 50 amperes

Specially designed for rural lines, where possible short circuit current is limited and where low cost is a major consideration. When a link blows, spring snaps unburned sections to ground. Time-delay switches in next fuse link.

Type RP2-56
two-shot recloser
5000 volts △; 50 amperes

Consists of two PVD single-shot drop-out fuse cutouts with time-delay mechanism, in a single porcelain housing. Bakelite doors remain closed whether cutout is fused or blown. Cartridge drops to indicating position easily visible from ground. Quickly re-fused on the pole.

LM

LINE MATERIAL
FUSE CUTOUTS & FUSE LINKS

L-M DISTRIBUTION EQUIPMENT INCLUDES: Distribution Transformers · Fuse Cutouts and Fuse Links · Lightning Arresters · Oil Switches · Pole Line Hardware · Line Construction Specialties · Underground Equipment · Fibre Conduit · Street Lighting Equipment

Why Western Electric equipment leads the way!

1. Western Electric products are designed by Bell Telephone Laboratories —world's largest organization devoted exclusively to research and development in all phases of electrical communication.

2. Since 1869, Western Electric has been the leading maker of communications apparatus. Today this company is the nation's largest producer of electronic and communications equipment.

3. The outstanding quality of Western Electric equipment is being proved daily on land, at sea, in the air, under every extreme of climate. No other company has supplied so much equipment of so many different kinds for military communications.

As you probably know, many of the electronic marvels of this war have been made possible by the successful harnessing of Super High Frequencies. The scientists at Bell Telephone Laboratories have taken a leading part in this work with MICROWAVES.

The devices they have designed have been built in vast quantities by Western Electric. In this work, Western Electric has added greatly to its fund of spe-

AM · BROADCASTING · FM | MARINE RADIO | AVIATION RADIO | MOBILE RADIO

Western Electric has specialized

cialized knowledge and its manufacturing techniques.

These wartime microwave developments hold great promise for the future of communications and television transmissions.

From the audio band and extending through the many services in the radio frequency spectrum up to the frontiers of super high frequencies, count on Western Electric equipment to lead the way!

Western Electric

Distributed by GraybaR Electric Company

During the 7th War Loan Drive, buy bigger, extra War Bonds!

SOUND SYSTEMS | TELEVISION | SOUND MOTION PICTURES | COMPONENT PARTS

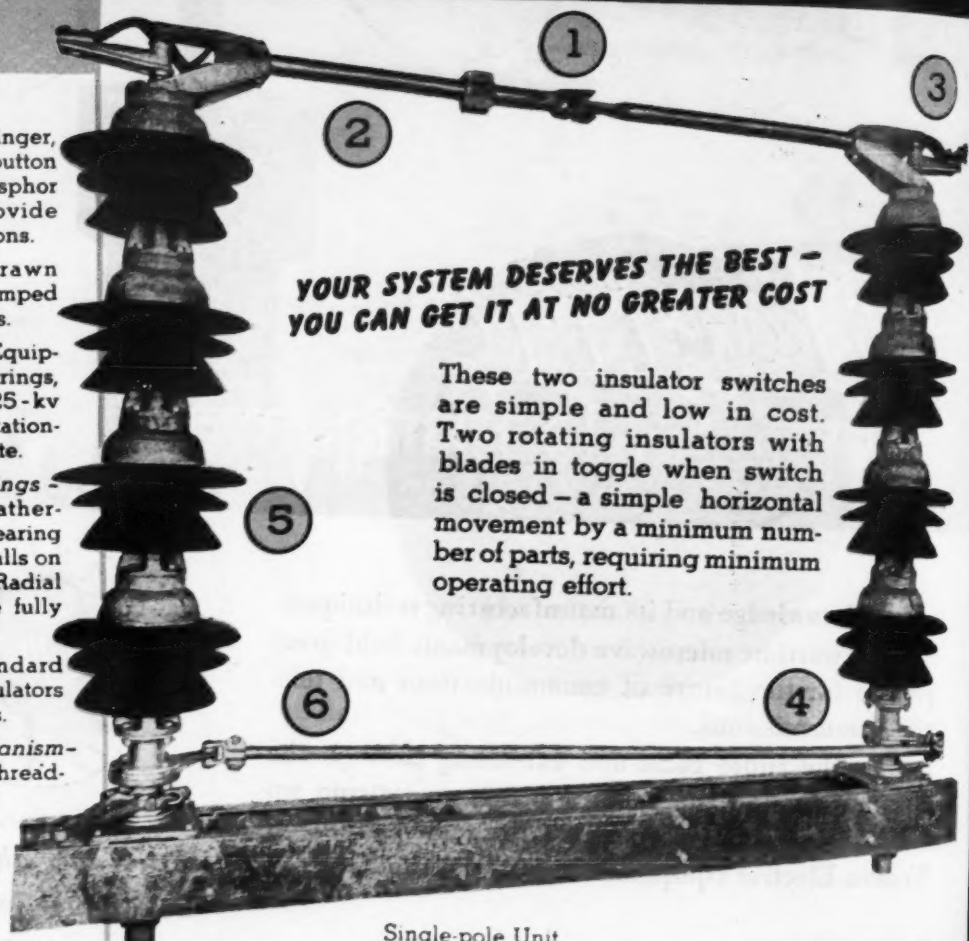
knowledge in all of these fields

"PM-22" SWITCHES WILL BEST SOLVE YOUR PROBLEM

WHEN — conditions dictate the use of horizontal break or when economy is a prime necessity.

Some Outstanding Features of the "PM-22"

1. *Contacts* – Multi-finger, high pressure button type. Laminated phosphor bronze springs provide high pressure at buttons.
2. *Blades* – Hard-drawn copper tubing clamped in non-ferrous saddles.
3. *Terminal Pads* – Equipped with ball bearings, on switches rated 25-kv and above, remain stationary as insulators rotate.
4. *Insulator Bearings* – Greaseless, weatherproof, rustless, ball bearing with stainless steel balls on all voltage ratings. Radial and thrust loads are fully supported.
5. *Insulation* – Standard B.I.L. switch insulators for all voltage ratings.
6. *Operating Mechanism* – Furnished with threadless fittings. Pipe piercing set screws in all fittings prevent slipping of parts once final adjustments are made.



YOUR SYSTEM DESERVES THE BEST — YOU CAN GET IT AT NO GREATER COST

These two insulator switches are simple and low in cost. Two rotating insulators with blades in toggle when switch is closed – a simple horizontal movement by a minimum number of parts, requiring minimum operating effort.

Single-pole Unit
161-Kv – 600-Amp

Available in all standard voltage ratings up to 169-kv and all ampere ratings thru 1,200-amps.

BUY EXTRA WAR BONDS – KEEP THOSE YOU HAVE

DELTA-STAR ELECTRIC COMPANY

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NEW YORK OFFICE — 140 Cedar St., New York 6, N. Y.

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San Francisco, Cal.
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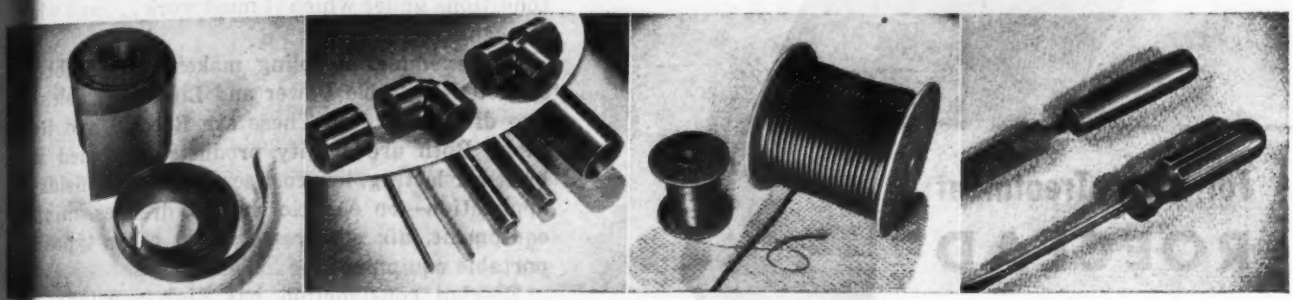
CANADIAN ASSOCIATE
Canadian Line Materials Limited — Toronto 13, Canada

what you should know about

STYRALOY

Dow's new plastic for electrical applications



Enthusiastic response from many electrical engineers followed the recent announcement of Styraloy 22. Such special interest is well-founded for this new, Dow developed synthetic elastomer already occupies an important place in the field of low-loss, low capacitance, high dielectric strength, insulating material.

Developed initially for insulation uses where low loss at high frequency was an important factor, Styraloy 22 soon attracted attention for other uses . . . for aircraft ignition installations because of its flexibility at low temperatures and freedom from corona attack even at high altitudes . . . for radio gaskets, bushings, and similar products . . . for combining with synthetic rubber to provide flexible, water resistant wire insulation.

These are some of the things you should know about Styraloy 22—so you can determine where this new product can best fit into your own plans. Complete data is available on request.

We at Dow know from experience that success in plastics is not a one-man nor even a one-industry job. It calls for the combined skill and cooperation of manufacturer or designer, plus fabricator, plus raw materials producer. Working together, this team saves time and money and puts plastics to work successfully. Call us—we'll do our part.

PRESENT AND POTENTIAL USES: One-piece cable sheathing; handles for tools, household appliances, etc.; gaskets; bushings; coil forms; floor mats; scuff plates; many applications still to be ascertained.

PROPERTIES AND ADVANTAGES: High dielectric strength, low power loss. Power factor only .005 at 100-300 megacycles. Flexible and shock resistant from —90° F. to 212° F. Specific gravity less than 1 (floats in water). Water absorption only .2 to .5%. Resists heat, ozone, and most chemicals. Highly resistant to abrasion. Resists permanent indentation. Readily suited to extrusion of complex cross sections and readily fabricated by other molding techniques. Easily machined.

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

New York · Boston · Philadelphia · Washington · Cleveland · Detroit
Chicago · St. Louis · Houston · San Francisco · Los Angeles · Seattle

DOW

PLASTICS

ETHOCEL • ETHOCEL SHEETING • STRIPCOAT
SARAN • SARAN FILM • STYRON • STYRALOY

ROEBLING PORTABLE

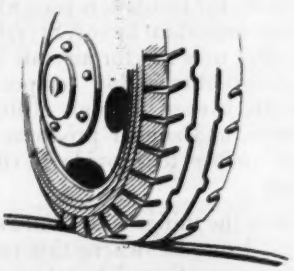
How to choose the right

SELECTING THE BEST TYPE ROEBLING CABLE for a specific job is a matter of knowing the service conditions under which it must work . . . and what the cable can do.

For example, Roebling makes Plain Rubber* Jacketed Portable Power and Lighting Cables of two distinct types: These are Roeclad and Roecable. Both are quality products—designed and built for lasting, low-cost service in their fields of application—on electric shovels, dredges, mining equipment, air compressors and other types of portable equipment.

Roeclad construction has high resistance to abrasion, impact or crushing pressure and adequate flexibility for normal, portable service applications . . . such as excavating, open pit mining and where the cable may be dragged over highly abrasive resistant surfaces, struck by falling rock, and run over occasionally by trucks.

Roecable construction has a greater degree of flexibility which gives it a high resistance to flex-



For Tough Treatment

ROECLAD

can resist a greater degree of impact and crushing than Roecable. Conductors are rope-laid, tinned copper strand. Insulation is a high grade Performance Type rubber compound, applied directly to the conductor. An open braid of heavy twine is applied over the insulation in single conductor cables, and over the rubber-filled core in multiple conductor cables. This braid acts as a reinforcement between the cable core and the tough, "lead-cured", rubber outer jacket.

* Selected synthetic rubber compounds, as permitted under WPB regulations, are now used in lieu of rubber in Roebling rubber-insulated wires and cables.

PACEMAKER IN WIRE PRODUCTS

WEATHERPROOF WIRE • SERVICE ENTRANCE CABLES RUBBER COVERED WIRES AND CABLES (INCLUDING THIN-WALL INSULATED BUILDING WIRES AND CABLES) RUBBER SHEATHED PORTABLE CABLES • MAGNET WIRE TELEPHONE WIRES • PIGTAIL AND BRAIDED COPPER TROLLEY CONTACT WIRE • RUBBER INSULATED POWER CABLES • VARNISHED CAMBRIC POWER CABLES • BARE COPPER STRAND

ROE

ELECTRICAL

OWER CABLES—

ype for your job!

Both Roeclad and Roecable are made with or without ground wires.

fatigue with good abrasion and impact characteristics. It will function on smaller barrel reels or sheave diameters better than the more rigid Roeclad construction.

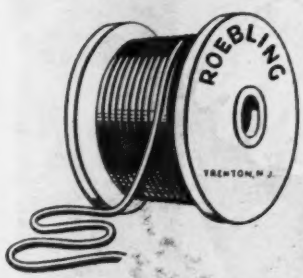
The proper choice of a cable depends upon *full information being available as to service conditions.* That's when judgment is required . . . in weighing the relative importance of the factors involved.

And that's when the advice and recommendations of experienced Roebling representatives can help you . . . to select the correct Roebling cable for maximum service on your job. Get in touch with our nearest branch office. A representative will gladly confer with you on problems of cable selection and maintenance.

JOHN A. ROEBLING'S SONS COMPANY

TRENTON 2, NEW JERSEY

Branches and Warehouses in Principal Cities



For Extra Flexibility

ROECABLE

is more flexible than Roeclad. Conductors, insulation and jacket are the same as Roeclad's, but the heavy twine reinforcing braid is omitted. In single conductor cables, the outer jacket is applied directly over the insulation and the two compounds bonded by vulcanization. In multiple conductor cables, the interstices between conductors are filled with jute or other suitable fiber instead of rubber. This assembled core is then served with rubber-filled tape before being enclosed in the rubber outer jacket.

BLING

JR ROEBLING

VIRES AND CABLES

we named him nubun

HE'S HEADED FOR BIG THINGS

IN THE ELECTRICAL WORLD

KEARNEY · HI-LINE · TOOLS FOR *Safety and*

The New Kearney Con-Nec-Tap Clamp Has Protected Threads for Easier Operation

1. Screw travels into sealed, waterproof chamber containing corrosive resistant lubricant. Assures clean threads for easy removal at any time and is a guarantee against clamp freezing on the line.

2. Heavy radius contact jaws provide a bell-mouth grip to prevent damage to conductor at the clamp due to line vibration.

3. Spring lock washer prevents clamp loosening from vibration and is powerful enough to take up any expansion of parts due to temperature changes or adjustment of conductor strands which may occur after installation.

On new construction or replacement work, this new Kearney Clamp will reduce your maintenance costs — easily installed with all standard eye Clamp Sticks.

The new Kearney protected-thread Con-Nec-Tap Clamp has been designed to offer a combination of advantages available for the first time in any clamp at a price comparable with conventional clamps in the same size range.

JAMES R. KEARNEY CORPORATION

OVERHEAD **UTILITY EQUIPMENT** UNDERGROUND

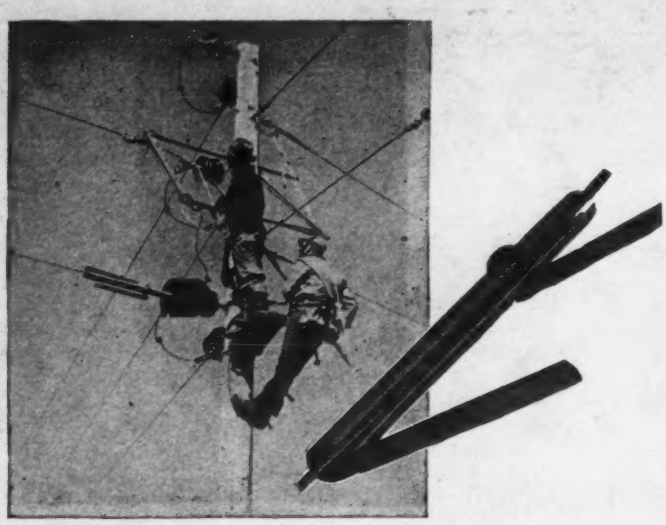
ARE DESIGNED

Convenience in Hot-Line Work!

KEARNEY HI-LINE JUMPER CLAMP WITH BUILT-IN LOAD PICKUP ELIMINATES THE DANGER OF BURNT CONDUCTORS DUE TO ARCING

The copper-rod pickup contact snaps securely into a spring contact in the line terminal by releasing bakelite sleeve grip on the handle after connection to the conductor has been made with the clamp at top. Point of contact is safely confined within the bakelite handle which has passed a minimum oil-immersion dielectric strength-test of 600 volts per mil. The clamp is built to carry 200 amperes without excessive heating.

There is an adjustable rubber guard on the handle to protect hands from accidental contact with conductor. A rubber cap on the head is provided for additional safety. Rubber gloves are recommended with this, as well as all other jumper clamps.



KEARNEY TEST FUSE HOLDERS

The Kearney Test Fuse Holder consists of standard Trip-O-Link Switch contacts attached to an insulating wood pole tested to 75,000 volts per foot.

Spring Type Con-Nec-Tap Clamp on upper member and eye at lower end to fit all standard Eye Clamp Sticks permits quick and easy installation. Arm on lower contact member is built to receive tap-off clamp from branch line.

The Kearney Test Fuse Holder is available in various lengths with a heavier spring type clamp — also with a cable lead and spring clamp attached to lower terminal.

KEARNEY SAFETY LINE GUARDS AND INSULATOR HOODS

These guards and insulator hoods protect your linemen against unnecessary pole hazards, thus expediting hot-line work through greater freedom of movement.

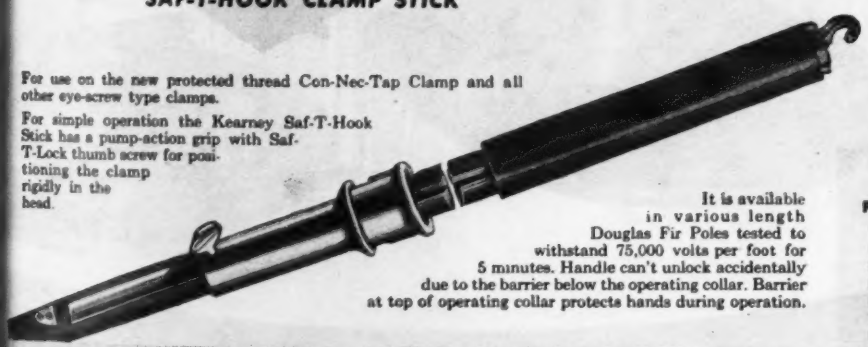
The line guards consist of two concentric bakelite cylinders insulated to handle as high as 23KV. Guard slips over line as shown in the illustration. A twist of the handles in opposite directions turns the cylinders so that their respective slots are opposite each other, thus locking them securely over the line and fully surrounding the conductor. Handles may be folded against guard to provide clearance.

An insulator hood of bakelite covers all insulators up to 23KV. Rope on top facilitates installation with han-pol, tie stick or other tool. Slots are provided to clear power leads. End openings fasten over the line guards to avoid separation while in use.

KEARNEY SIMPLE TO OPERATE SAF-T-HOOK CLAMP STICK

For use on the new protected thread Con-Nec-Tap Clamp and all other eye-screw type clamps.

For simple operation the Kearney Saf-T-Hook Stick has a pump-action grip with Saf-T-Lock thumb screw for positioning the clamp rigidly in the head.



It is available in various length Douglas Fir Poles tested to withstand 75,000 volts per foot for 5 minutes. Handle can't unlock accidentally due to the barrier below the operating collar. Barrier at top of operating collar protects hands during operation.

"Partners"

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO

Partial List of Kearney Tools

- TRANSFORMER HOISTS
- LEVER CUTTERS
- DEAD END TOOLS
- PLATFORMS
- CUM-A-LONGS
- TIE STICKS
- LIFT POLES & SUPPORTS
- JUMPER CLAMPS
- GROUNDING EQUIPMENT
- DISCONNECT STICKS
- SPRING TYPE HOT LINE CLAMPS
- TRUSS PIN WRENCHES & SOCKETS

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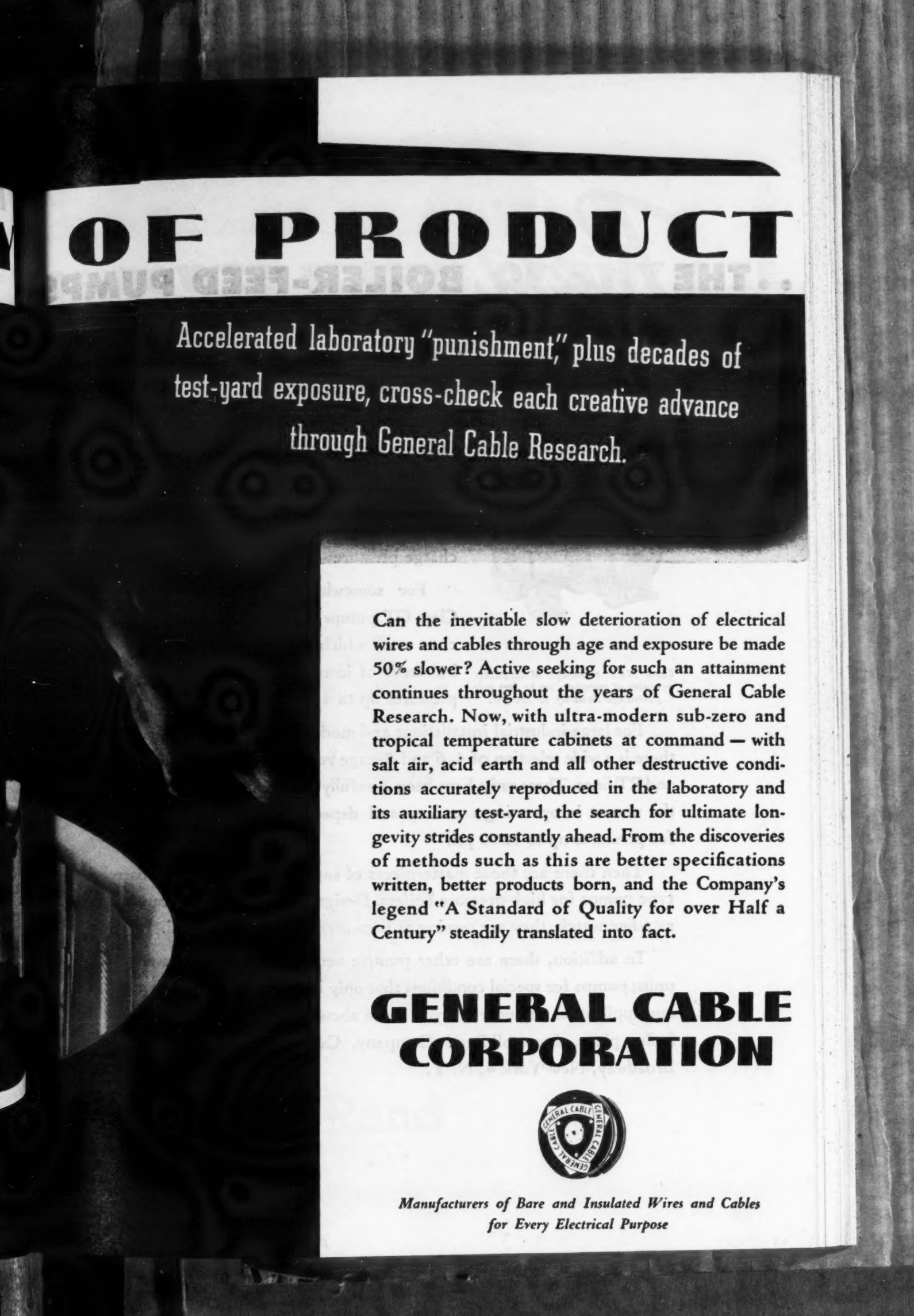
CANADIAN PLANT • LEASIDE, ONTARIO

LONGEVITY

Here, the moisture-permeability of a synthetic is tested in the "Weatherometer", a device which accurately measures the relative time-resistance of various insulating materials to the most damaging elements of weather:—ultra-violet rays, wind, moisture.



OF PRODUCT

Accelerated laboratory "punishment," plus decades of test-yard exposure, cross-check each creative advance through General Cable Research.

Can the inevitable slow deterioration of electrical wires and cables through age and exposure be made 50% slower? Active seeking for such an attainment continues throughout the years of General Cable Research. Now, with ultra-modern sub-zero and tropical temperature cabinets at command — with salt air, acid earth and all other destructive conditions accurately reproduced in the laboratory and its auxiliary test-yard, the search for ultimate longevity strides constantly ahead. From the discoveries of methods such as this are better specifications written, better products born, and the Company's legend "A Standard of Quality for over Half a Century" steadily translated into fact.

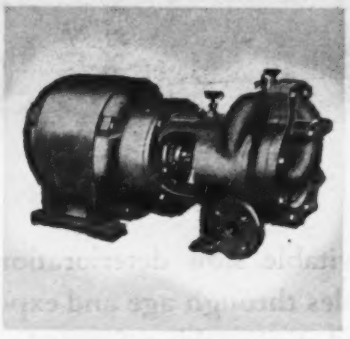
GENERAL CABLE CORPORATION

Manufacturers of Bare and Insulated Wires and Cables for Every Electrical Purpose

..THE *Right* BOILER-FEED PUMPS

There is a modern and efficient Ingersoll-Rand boiler-feed pump for any boiler plant from the smallest to the largest.

For small and moderate sized industrial plants, the two-stage Motorpump is ideal. The motor driver is built on the same shaft as the pump making a unit of extreme compactness. Built-in turbine-driven units of the same design are also available. They operate at discharge pressures up to 250 psi.



Class MRV two-stage Motorpump operates at pressures up to 200 psi, four-stage units up to 250 psi.

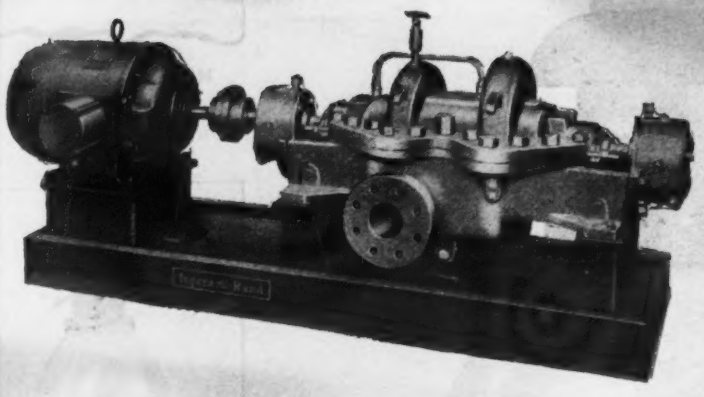
For somewhat larger plants, two-stage Class GT pumps are available. They are efficient units which have proved themselves in hundreds of installations. They are built for pressures up to 450 psi.

For large industrial installations and moderate size utility installations, there is a wide selection of 4, 6 and 8-stage volute type pumps in the CNT and RT lines. These units have been carefully designed and built to secure the utmost in operating economy and dependability. They are suitable for pressures up to 1200 psi.

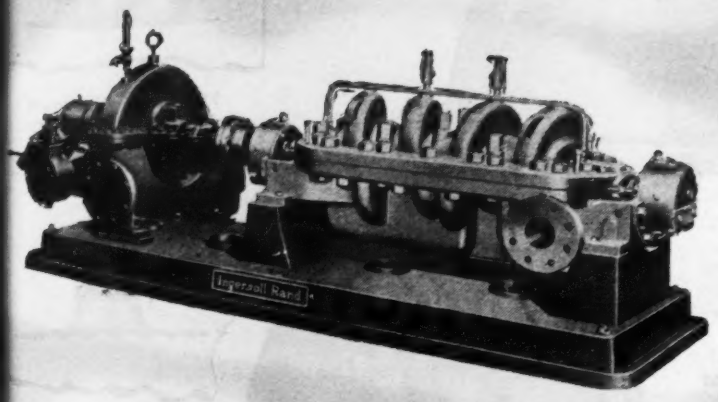
Then there are those masterpieces of super-precision, the I-R barrel type pumps for high-pressure boilers. Designed and finished as carefully as a fine watch, they are serving at pressures as high as 2900 psi.

In addition, there are other pumps; vertical units and diffusor-type units; pumps for special conditions that only Ingersoll-Rand can meet. Let our application engineer tell you more about the pump that will fit your boiler plant. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

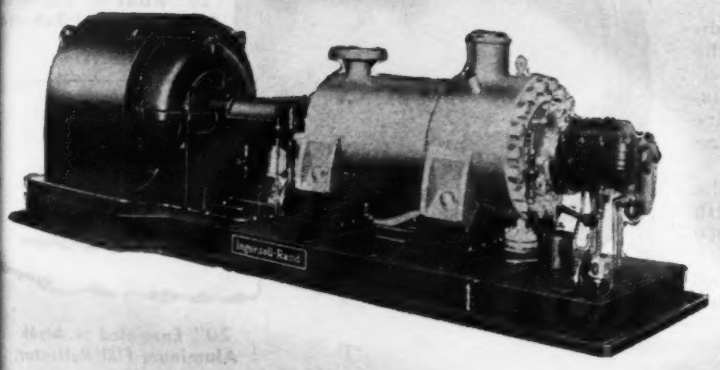
FOR POWER PLANTS OF ANY SIZE



Class GT two-stage pump for pressures up to 450 psi.



Class CNT pump. Available in 4, 6 or 8 stages for pressures up to 800 psi. Class RT units of similar basic design serve at pressures up to 1200 psi.



Class CHT pump. Units of this class are serving at pressures up to 2900 psi.

Ingersoll-Rand

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CAMERON PUMP DIVISION

10-633

COMPRESSORS · AIR TOOLS · ROCK DRILLS · TURBO BLOWERS · CONDENSERS · CENTRIFUGAL PUMPS · OIL AND GAS ENGINES

JOSLYN

TYPE C LUMINAIRES

INTEGRAL FLANGE

NO MORE ADAPTERS

Joslyn type C luminaires have many distinctive features among which are the following: The wet process porcelain head has an integral porcelain flange which permits direct attachment of the reflector without the use of metal adapters and spring latches. This assures a weather tight joint.

The series receptacle is adjustable. Just loosen the two large machine screws which extend through the external terminals, then push the socket and receptacle assembly to the top position or pull it to the bottom position. These are the only settings required to obtain the correct lamp position for 10,000 lumen or smaller lamps used with any of the open type reflectors or reflector-glassware assemblies.

The glassware holding ring is a one piece aluminum casting which extends above the top edge of the glassware eliminating the possibility of breakage when opening or closing.

The inner deflector, when used, is attached directly to the glassware holding ring instead of the old method of attachment to the reflector. This allows conversion from symmetric to asymmetric distribution by merely attaching the desired glassware and holding ring assembly, which can be done quickly without the use of tools.

The wet flashover from the terminals to the canopy is in excess of 30 KV. The tensile strength of the porcelain attachment flange is over 2000 pounds.

High flashover voltage — No metal adapters — Socket easily adjusted—Conversion simple—One head to stock.

Holophane Refractor or Rippled Globe.

18" Alzak Aluminum Spherical Bowl Reflector.

20" Alzak or Enameled Aluminum Bowl Reflector.

20" Enameled or Alzak Aluminum Flat Reflector.

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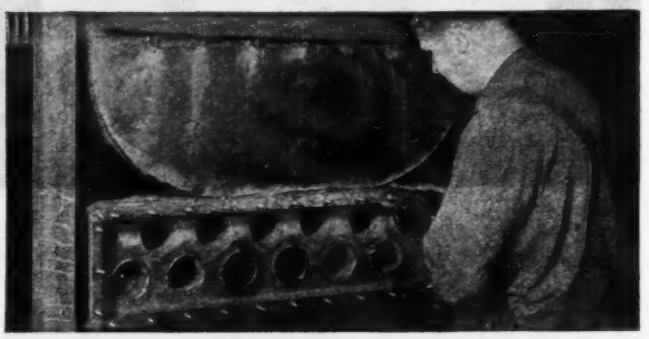
Eliminate drilling and tapping studs with NELSON STUD WELDING!

After layout and centerpunching the studs are welded to the metal. The stud is inserted in the gun chuck, the trigger pulled and a complete, full-fillet weld results. Operators can weld from 500 to 1500 studs in eight hours without difficulty. A template may be used if desired.

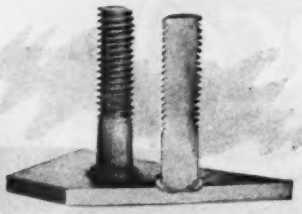
Nelson Stud Welding saves time and material because studs are end-welded to metal without drilling or tapping to secure them. Uniform welds, with full fillet, result every time . . . complete fusion between the stud and metal is obtained in ½ second.

The Nelson Stud Welder is *fully automatic* and completely portable. Light in weight and easy to use, it welds effectively in any position. Or it may be operated as a production unit from a fixed jig. Thousands of these automatic welders are now being used in more than 650 industrial plants. No previous welding experience is necessary.

Write today for complete details about the Nelson Stud Welder, catalog and price list.



Inspection covers are an excellent application for stud welding because the studs are easily and accurately located without drilling and tapping. Welds are as strong as those made by any other method.



Cutaway view of stud after welding and etching with Nital shows the complete fusion of the stud to metal. Fillet is not only around outer surface of the stud but weld is a complete fusion of the stud to metal.

For complete details, prices and catalog write:

NELSON SPECIALTY WELDING EQUIPMENT CORP.
Dept. EW, 440 Peralta Ave., San Leandro, Calif.

Eastern Representative: Camden Stud Welding Corp.
Dept. 122, 1416 South Sixth Street, Camden, N. J.

RCA Announces its New

195 VoltOhmyst

4 IMPORTANT NEW FEATURES

1. Diode for a-c measurements. Flat 2 cycles to 100 kc.
2. Linear a-c scale for all ranges.
3. New plastic meter case with one-piece crystal-clear transparent front. No glass to break or loosen.
4. Shielded a-c cable and probe.

Send for Bulletin:

A special bulletin showing and fully describing this new improved version of the well-known VoltOhmyst is now being printed. Fill in and return the coupon for your copy.

BUY MORE RCA WAR BONDS

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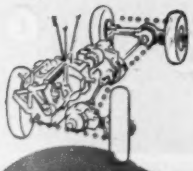
FWDs ARE RUGGED *Dependable* PRIME MOVERS

In everyday duty for utilities, FWDs regularly do 61 jobs. Including special jobs, there are more . . . write for list. For all year 'round utility truck work, you can always depend on FWDs.

FWD trucks . . . rugged, reliable, modern . . . embody the highest development of the original four-wheel-drive principle, pioneered and advanced by FWD since 1910. The true FWD principle with center differential and properly balanced power on all wheels, gives these trucks outstanding mechanical advantages and performance leadership . . . the FWD principle that provides the power and stamina to get through . . . regardless of weather, road conditions or lack of roads . . . with greater assurance and safety. Balanced weight distribution on all four wheels conserves precious tires, replacements, oil and gas. As leaders in performance, economy and style, FWDs are a great "buy" for utilities. Their value is so widely recognized that they are used by over 200 utilities, many of which operate large FWD fleets.

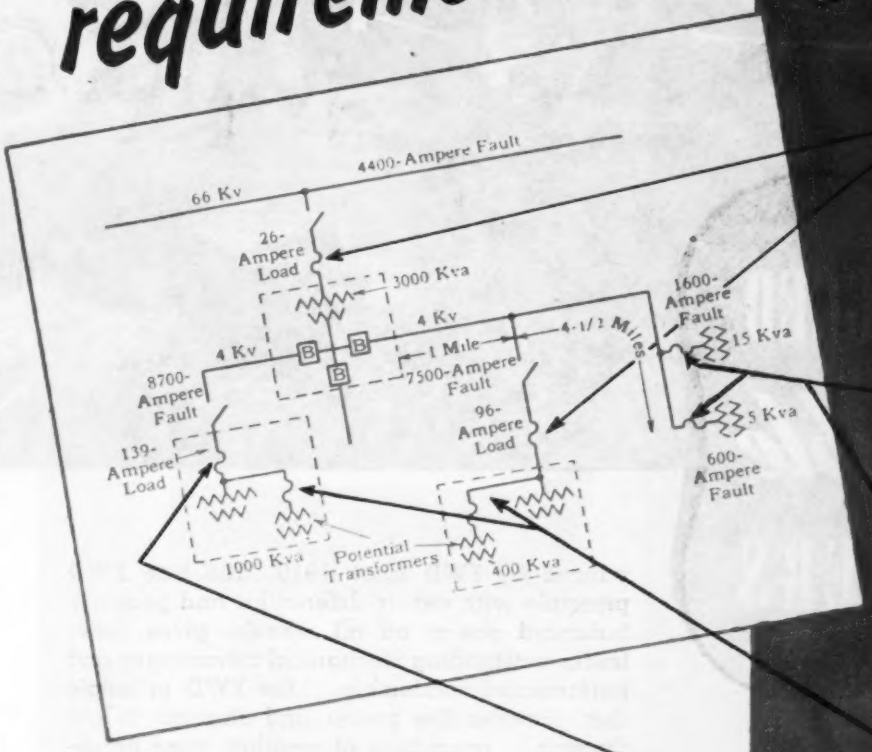
THE FOUR WHEEL DRIVE AUTO COMPANY, Clintonville, Wisconsin
Canadian Factory: Kitchener, Ontario

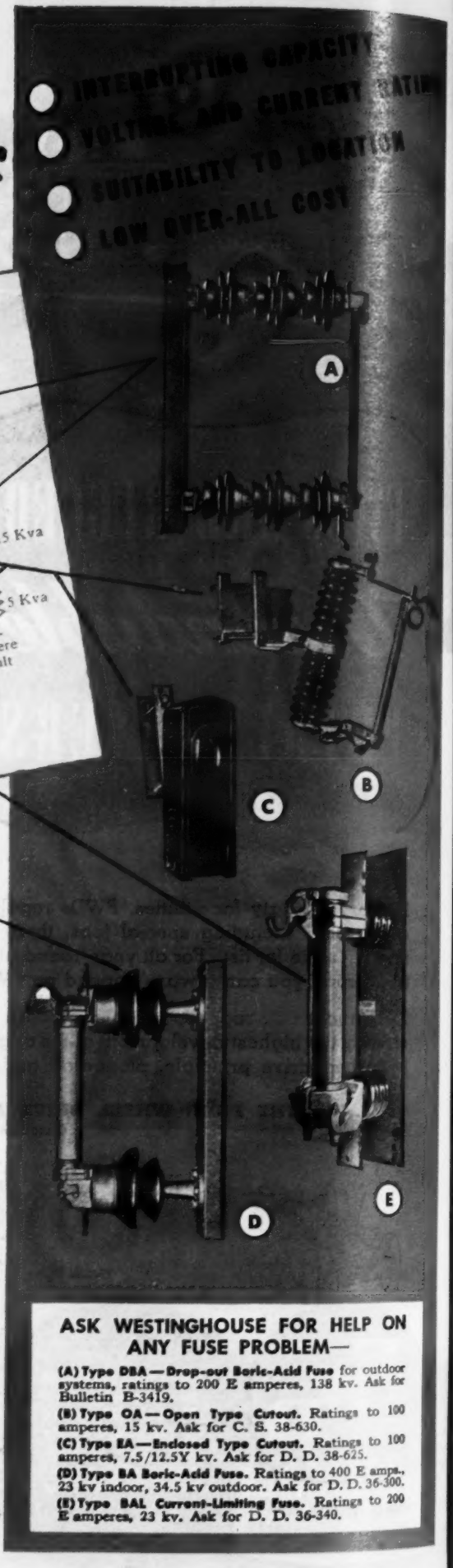


FWD
TRUCKS
THE ORIGINAL EXCLUSIVE BUILDERS OF FOUR-WHEEL-DRIVE TRUCKS

More than $75,000,000 in purchases of FWD Model SU alone in the comparatively short span of forty-eight months, emphasizes FWD leadership in this field!

all 4 basic requirements of





...are met by a type of fuse from the *complete line of Westinghouse fuses—for ANY service*

The Westinghouse fuse service—the most complete line of fuses available anywhere *plus* decades of fuse application experience—is yours for the asking.

If you are in doubt about the rating, or suitability of any type of fuse for service in your system, why not consult a Westinghouse engineer? When full consideration is given to the four basic requirements listed above, selection of the proper fuse is simplified. It becomes clear why one fuse should be used in preference to another—especially when over-all cost is considered. So call your Westinghouse office and save time.

The fuses shown at right typify the completeness of the Westinghouse line of fuses . . . for all power distribution and industrial services . . . in all kinds of operating conditions. For more information ask for bulletins indicated. Write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60579

ASK WESTINGHOUSE FOR HELP ON ANY FUSE PROBLEM—

(A) Type DBA—Drop-out Boric-Acid Fuse for outdoor systems, ratings to 200 E amperes, 138 kv. Ask for Bulletin B-3419.

(B) Type OA—Open Type Cutout. Ratings to 100 amperes, 15 kv. Ask for C. S. 38-630.

(C) Type EA—Enclosed Type Cutout. Ratings to 100 amperes, 7.5/12.5Y kv. Ask for D. D. 38-625.

(D) Type BA Boric-Acid Fuse. Ratings to 400 E amps., 23 kv indoor, 34.5 kv outdoor. Ask for D. D. 36-300.

(E) Type BAL Current-Limiting Fuse. Ratings to 200 E amperes, 23 kv. Ask for D. D. 36-340.

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PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

COMPLETE FUSE SERVICE

New Jobs for PREHEAT ENGINEERING

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Separately-fired units for extra-high superheat — Improved operation of kilns and dryers.

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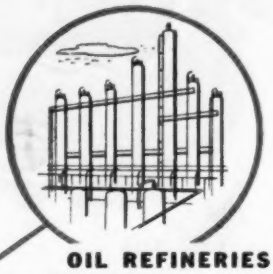
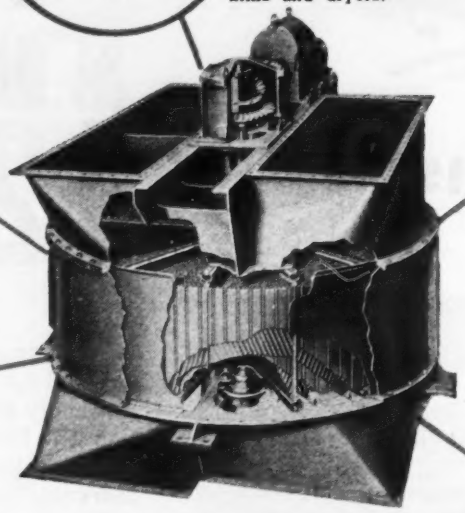
increase by-products and d both efficiency and speed waste disposal by supply- high-temperature air for hydration.



OIL REFINERIES
Heat recovery on cracking stills.



WHAT HAVE YOU?
Maybe you have some process which could profitably use preheat engineering.

THE *Ljungstrom* AIR PREHEATER

The continuous, regenerative, counterflow principle of the Ljungstrom Air Preheater provides maximum heat transfer with minimum size and weight. The rotating, cylindrical heat transfer surface absorbs heat in the gas chamber; then rotates to the chamber where it gives up this heat to the entering air.

SMELTERS
To increase temperature and output of reverberatory smelter furnaces, where capacity increases up to 50 per cent may be anticipated.

YEAR after year, industry puts the Ljungstrom Air Preheater to work at new tasks, performing them better or more economically than before. Many of these new applications are far removed from the primary function of waste heat recovery at steam generating plants.

Today, refinery, synthetic rubber and metallurgical applications of the Ljungstrom are widespread, and increasing. Among the newer users of the Ljungstrom are chemical plants, refineries, smelters and waste disposal plants.

Other industries are investigating the possibilities of the Ljungstrom applied to their processes. If you are using heated air or gas for any purpose, it may pay you to investigate the possibilities of the Ljungstrom Air Preheater in speeding processes and cutting costs wherever gas-to-air, gas-to-gas or air-to-gas heat transfer is needed.

ENGINEERING SERVICE

The engineering staff of the Air Preheater Corporation is prepared to assist you in applying standard or special types of Ljungstrom Preheaters to your individual need.

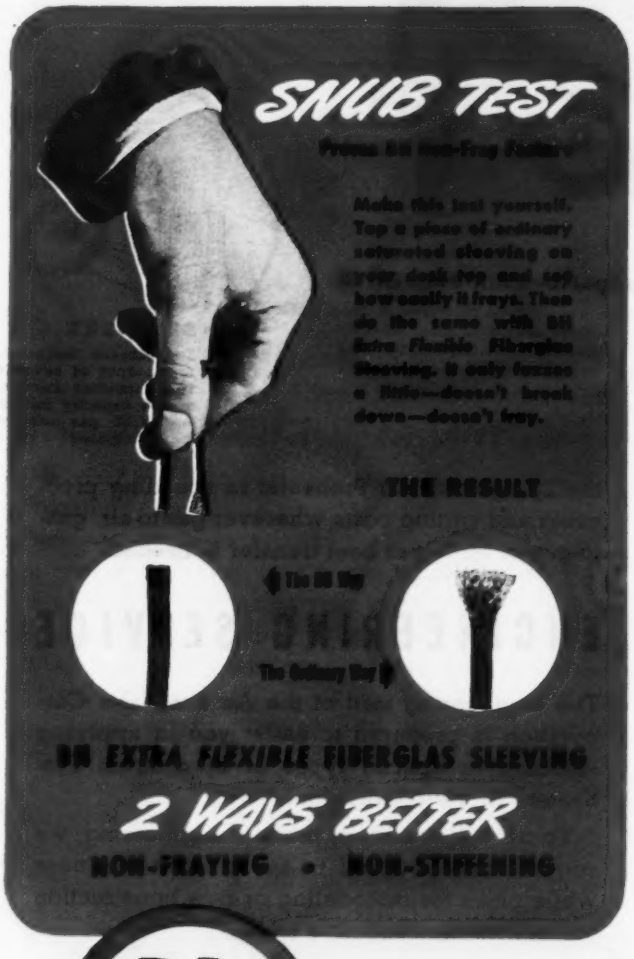
To get full benefit of preheat engineering, we suggest that you call in the preheat engineer while plans for remodeling or new construction are still in the formative stage.

THE
AIR PREHEATER
CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

BH SPECIAL TREATED FIBERGLAS SLEEVING

HEAT RESISTANT TO 1200° F!



IF YOU NEED an electrical insulation that's not affected by temperatures up to 1200°F., yet is unusually flexible, workable and durable, you'll find it in BH Special Treated Fiberglas Sleeving. Even in direct contact with heat units this remarkable sleeving won't burn.

Reason? It's made of inorganic Fiberglas and treated by the exclusive BH process. No saturant is used, yet the sleeving won't fray when cut and it is *permanently* flexible. In addition to many other properties it is moisture, oil and grease resistant . . . works easier, simplifies assembly and lasts longer. Made in natural color only—all standard sizes. Get your free samples today and compare!

HERE'S ANOTHER NON-BURNING SLEEVING

BH *Extra Flexible* Fiberglas Sleeving won't burn because both yarns *and* impregnation are non-inflammable. This high quality sleeving has all the advantages of pure Fiberglas, is toughened against abrasion, is non-fraying and non-stiffening. It lasts indefinitely without rotting or cracking—the ideal all-purpose electrical insulation for all kinds of industrial equipment and home appliances. Available in all standard colors and sizes from No. 20 to 5/8", inclusive. Put it to the toughest tests you know and watch the results!

ALL BH PRODUCTS AVAILABLE IN STANDARD 36" LENGTHS AND 500-FT. COILS

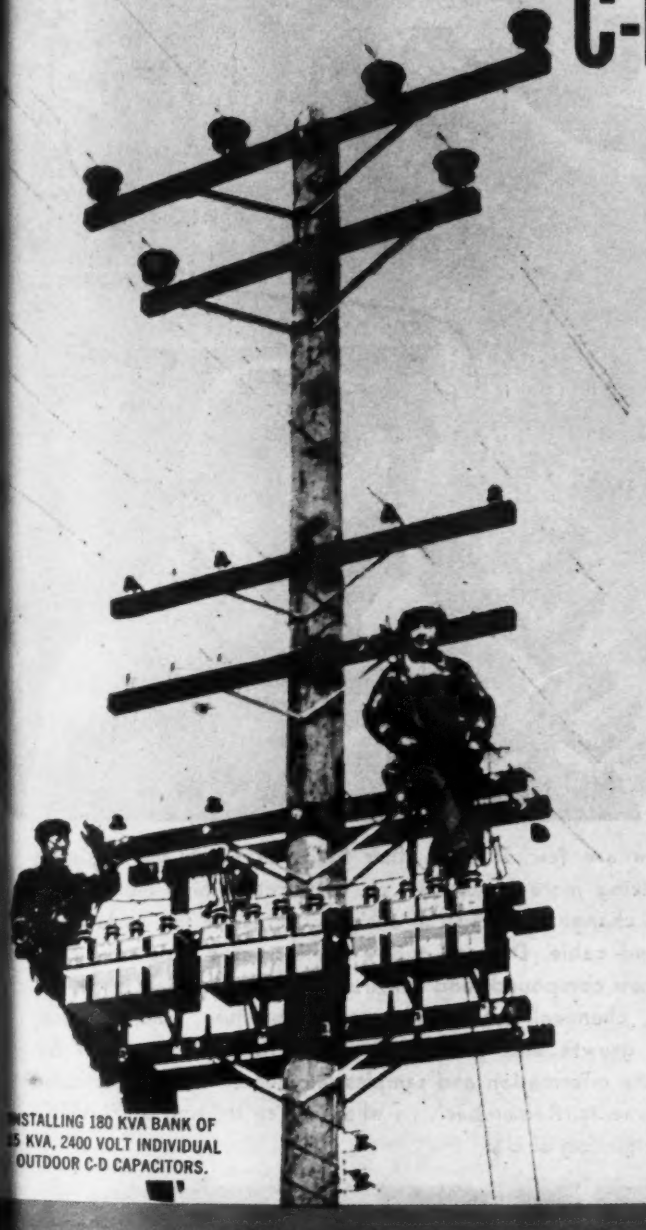
BH PRODUCTS

ALSO SLOW-BURNING IMPREGNATED ASBESTO TUBING • SLOW-BURNING FLEXIBLE VARNISHED TUBING • SATURATED SLEEVING • A.S.T.M. SPECIFICATIONS

BENTLEY, HARRIS MANUFACTURING CO.

Dept. W Conshohocken, Penna.

MORE VOLTAGE where you need it QUICKLY with C-D CAPACITORS...



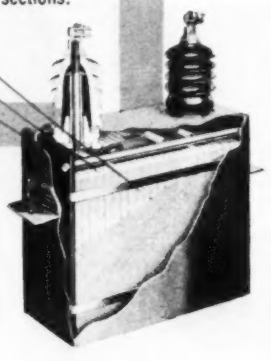
INSTALLING 180 KVA BANK OF 15 KVA, 2400 VOLT INDIVIDUAL OUTDOOR C-D CAPACITORS.

C-D Capacitors answer the problem of low voltage by adding the required Kva to your present distribution system without new feeders or sub-station equipment. Installed at critical load points, they are easily moved to other locations as need arises. Easy to get, simple to install, requiring little time, they provide the physical and electrical flexibility to meet your power-factor requirements quickly and economically.

Your local C-D field engineer will be glad to answer questions or suggest specific applications of C-D capacitors. Take advantage of his specialized knowledge and experience. Write Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Individual C-D Dykanol outdoor capacitor 15 Kva, 2400 volt, 1 phase, 60 cycle. Extra quality features are:

1. Stacking of sections is uniform.
2. Sturdy steel tension bands equalize pressure throughout capacitor.
3. Compact rigid end plates assure uniform pressure on stacked sections.

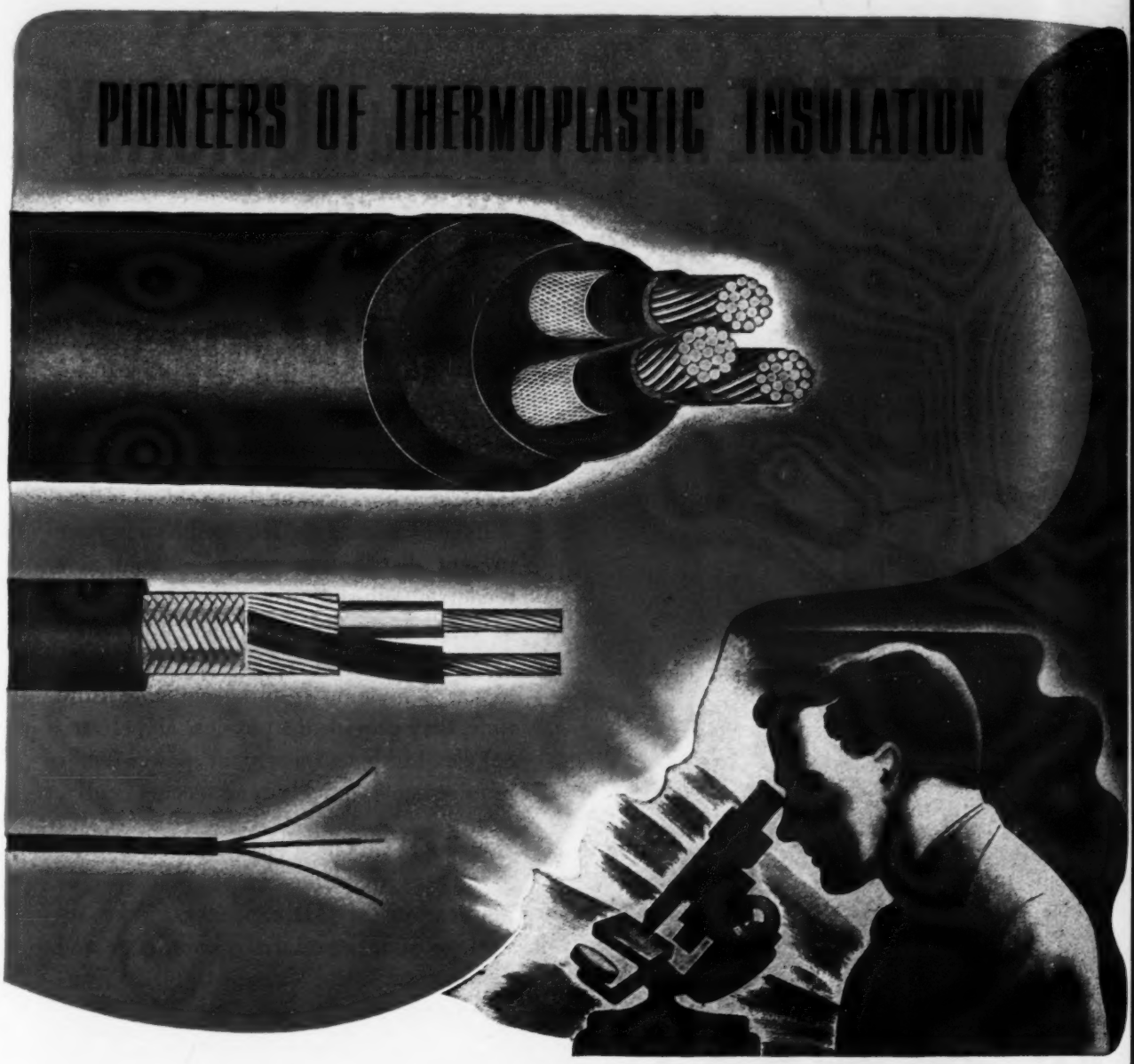


CORNELL-DUBILIER CAPACITORS

1910 1945

FOR POWER FACTOR IMPROVEMENT
CARRIER CURRENT COUPLING
SURGE PROTECTION

PIONEERS OF THERMOPLASTIC INSULATION



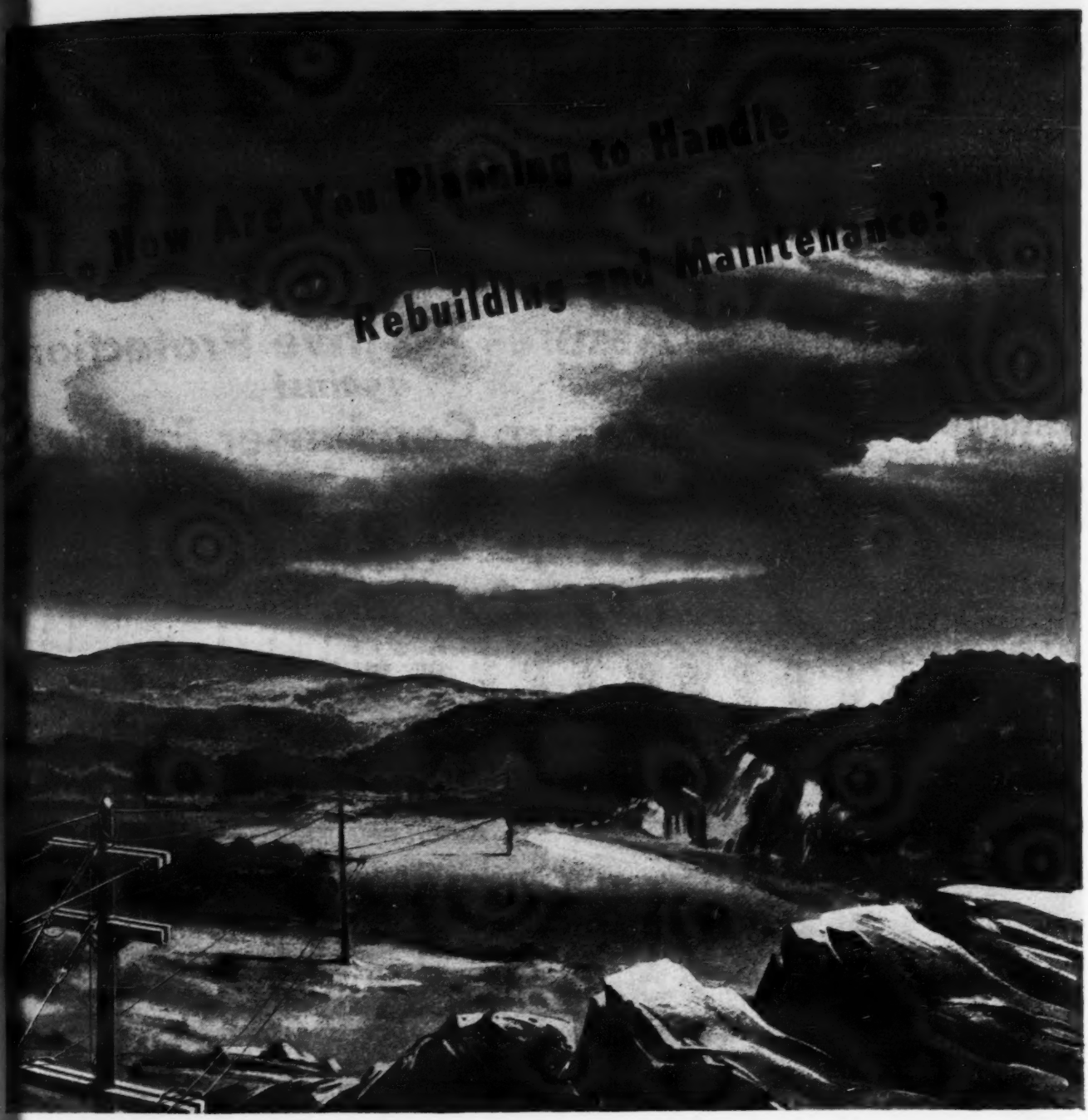
Thermoplastic insulation specialists . . . producing a complete line from fine wires to heavy power cables . . . serving: Public Utilities, Radio, Electronic, Appliance and Instrument Manufacturers, Telephone Companies and Contractors.

There are few, if any, other fields in which thermoplastics are solving more problems . . . or accomplishing more fundamental changes in industrial design . . . than in the insulation of wire and cable. Demand today the increased resistance which these new compounds and constructions offer to heat, flame, oxidation, chemical action, oil, grease, moisture, cold, abrasion, fungus growth and other severe conditions. Write NOW for complete information and samples engineered to your particular requirements. Remember . . . when you're thinking of PLASTIC you're thinking of US!

PLASTIC

WIRE & CABLE CORPORATION

NORWICH CONN.



Despite the easement of manpower, postwar rebuilding and maintenance will continue to present problems of efficiency and economy. For more than 26 years, Hoosier engineers and trained men have served utilities in the erection and maintenance of transmission lines. Why not plan now to let Hoosier handle your postwar building and maintenance?

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NEW YORK **46 S. FIFTH ST., COLUMBUS, OHIO** CHICAGO

The Test Panel shown here, made by the Standard Electric Time Co. of Springfield, Mass., is equipped with 54 HEINEMANN Panel Type Breakers with INSTANTANEOUS Trip. They are so connected that any single condenser failure will cause the group circuit breaker to open fast enough to avoid creating a voltage surge which might cause failure of the whole group.

HEINEMANN CIRCUIT BREAKERS ARE ENTIRELY MAGNETIC

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HEINEMANN CIRCUIT BREAKER CO.

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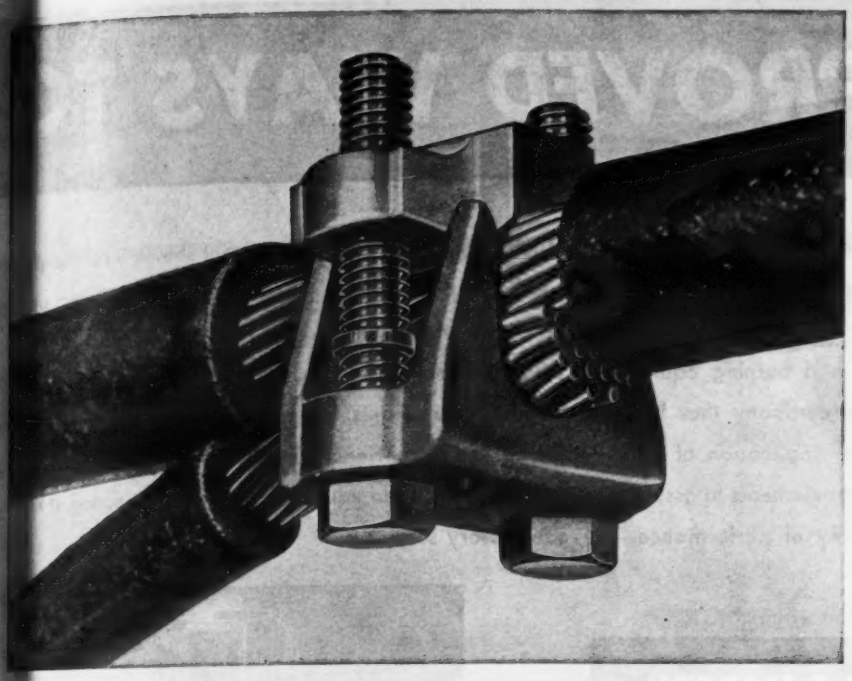


A NEW CONNECTOR FOR LARGE CONDUCTORS

- GREAT HOLDING POWER
- EASIER TO INSTALL
- ONE PIECE DESIGN
- VIBRATION-PROOF
- REDUCED COSTS
- RE-USABILITY

MATTHEWS UNICLAMP CONNECTORS

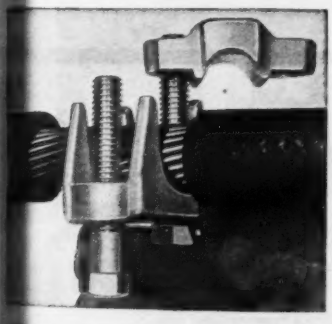
MATTHEWS UNICLAMP CONNECTORS insure permanently tight, trouble free connections for large size copper or aluminum wires from 2/0 to 1000 MCM inclusive. They meet the need for a more efficient, easier installed, less costly connector than the split bolt design or other clamp type designs for these large size conductors. They will accommodate two conductors of their rated size or one conductor of their rated size with one or more smaller tap-off wires, down to No. 8 solid.

The assembled design is such that the parts cannot become separated, therefore, in effect, it is a one piece connector. This feature permits ease of installation on energized lines with standard hot line tools and socket attachments to fit heads of cap screws.

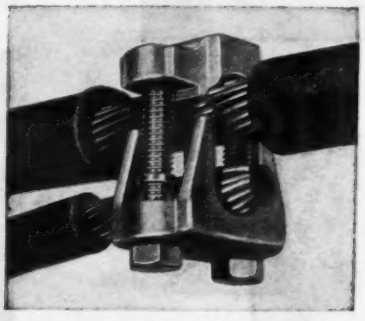
Cast bronze clamping members (having large contact surfaces) and Duronze cap screws provide high mechanical strength, hence long life and re-usability. They have exceptional holding power and can be securely tightened with a 6 or 8 inch wrench. They will not loosen when tightened, as a locking effect is created because of the very slight bending of the upper clamping member which biases the threads in it against the threads of the cap screws.

These connectors are very compact and make a neat connection when taped.

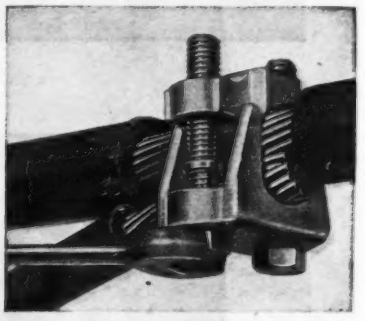
Matthews Uniclamp Connectors grip all wires with greater holding power than Split Bolt Connectors and without distortion of the Connector parts, therefore spacer bars between the main conductors and tap-off wires are not necessary; however, such spacer bars can be furnished if required.



t on conductor as above, position pper member as in view to right and partially thread in free cap screw.



With connector in position on conductor as shown, install tap-off wire and equally draw up cap screws.



Continue to draw up cap screws until connector is securely tightened. Note easy access of wrench to heads of cap screws.

FOR FURTHER INFORMATION REQUEST BULLETIN 206

W. N. MATTHEWS CORPORATION

SAINT LOUIS, U. S. A.

ENGINEERS and MANUFACTURERS SINCE 1899

. . NINE PROVED WAYS TO

When it comes to translating power plans into power plants, the Babcock & Wilcox Company can supply reliable and efficient boiler units complete with all essential components from fuel preparations and burning equipment to breechings and stacks. The company thus has control over both the designing and application of the equipment and coordinates the various elements to assure maximum dependability and economy of performance.

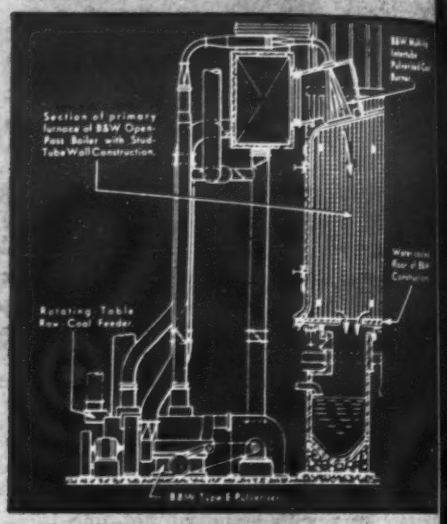
Much of the component equipment shown on these pag can be applied to modernizing, and thereby step up t efficiency of, existing power facilities.

When you select B&W steam-generating equipment f large or small plants, you get the benefit of over 60 ye specialized experience in designing and fabricati boilers and related equipment with a long record of high satisfactory service.

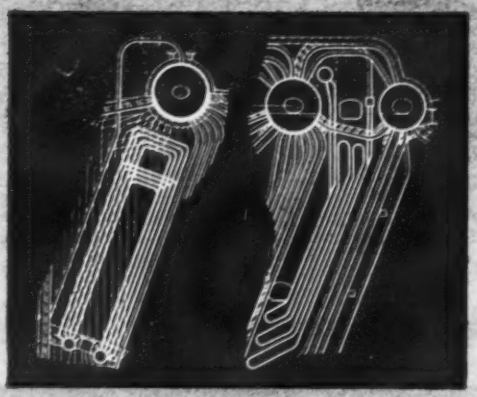
SEVEN STEPS TO A MODERN POWER PLANT

1. List minimum equipment and material essential to keep plant running for perhaps three years.
2. Meter, check, or estimate use of kwhr, steam, water, and air for each plant use, keeping postwar expansion possibilities in mind.
3. Make rough plan of the entirely new plant you would want to serve these needs. Secure costs of equipment and construction from consulting engineer or direct from manufacturers.
4. Compare new-plant plans with existing layout to find points of parallel arrangement, suitable locations for needed new items, building changes and the like.
5. Estimate fuel, labor and perhaps maintenance savings for each step of the modernization.
6. Calculate how long each individual improvement will take to pay for itself.
7. Prepare brief report suggesting that needed steps be approved first. Optional improvements can then be examined individually on the basis of the savings each will effect.

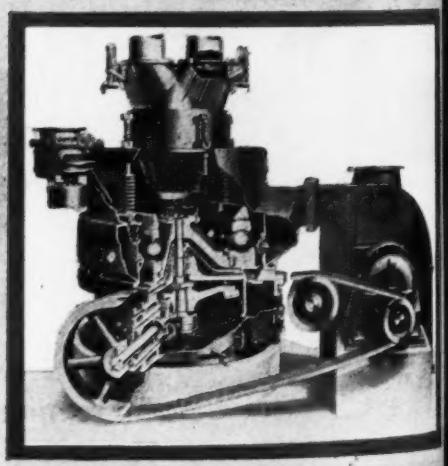
From POWER, December 1944.



B&W DIRECT-FIRING PULVERIZED-COAL SYSTEM. B&W direct-firing pulverized-coal system has advantages in ease of operation, reliability and upkeep that make it economical for small as well as large boilers. It is readily applied to oil-fired boilers for conversion to coal firing.

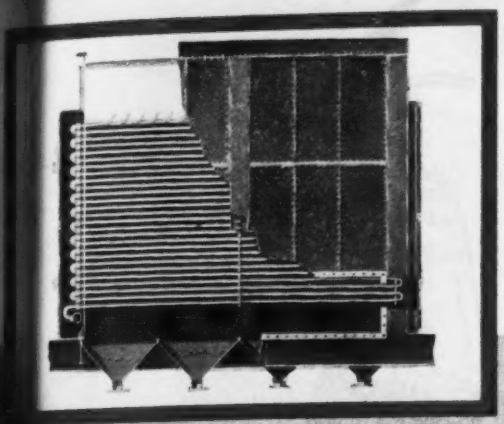


SUPERHEATERS. B&W Superheaters are properly designed and fabricated, with respect to steam and gas flow, to function efficiently with boilers designed and built by B&W. Available in both draining and non-draining types as shown.

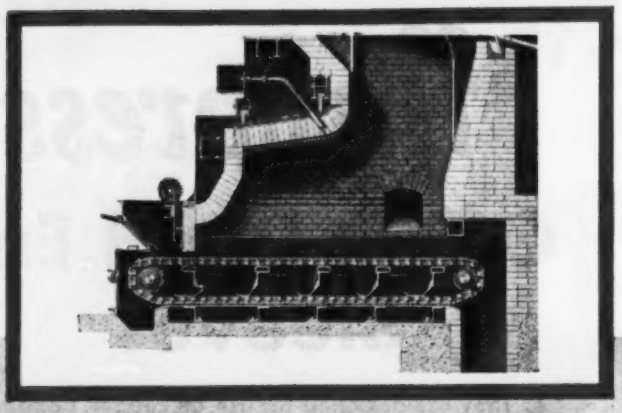


B&W PULVERIZERS. The simplicity and sturdiness of B&W ball-bearing type pulverizers assure high availability with low maintenance in direct-firing pulverized-coal systems. They provide consistently high fineness and respond quickly to changes in load with automatic control of raw-coal feed.

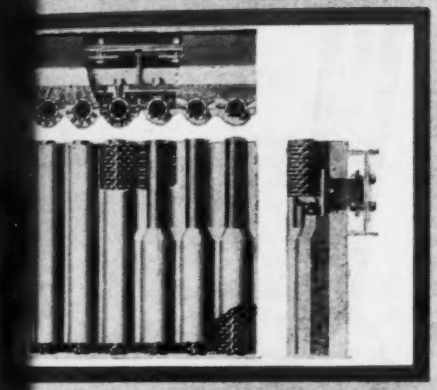
OOST BOILER EFFICIENCY



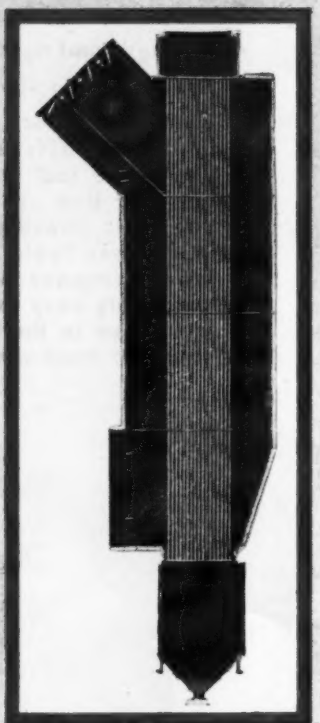
OMIZERS. B&W Economizers effect appreciable sav- in fuel and can be built to meet the size and pressure ements of any installation. The Return-Bend Econo- shown can be easily cleaned, and pressure parts may pected externally while in service.

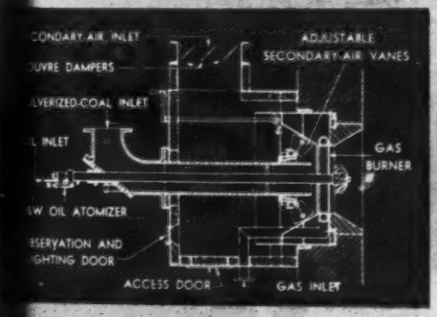


CHAIN-GRATE STOKERS. Babcock & Wilcox Chain-Grate Stokers are widely used with free-burning bituminous coal, anthracite, lignite, and coke breeze. They can be furnished for natural, induced, or forced draft, depending upon operating conditions.

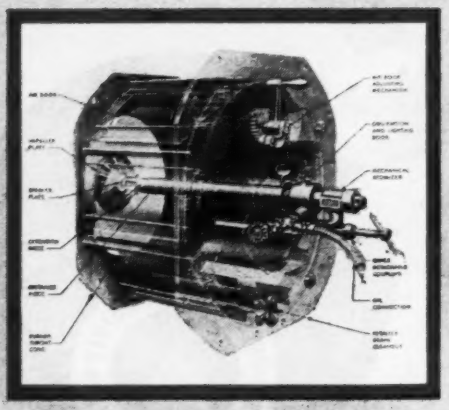


WATER-COOLED FURNACE CONSTRUCTIONS. B&W Water-Cooled Furnace Constructions are extensively applied for partial or complete water cooling of furnaces of all sizes, shapes, and forms, and with all fuels and combustion methods. Studded-tube type of construction is shown.





LTIFUEL CIRCULAR BURNER. Pulverized solid ls, oil, and gas are burned singly or in any bination with this burner. It provides a single ans of efficiently burning a wide range of fuels, mitting advantage to be taken of variations in availability and market prices of these fuels.



OIL BURNERS. B&W Oil Burners effect rapid and complete combustion at all rates of fuel feed, using mechanical, steam, or steam-mechanical atomizers, depending on the oil and operating conditions. Available in a range of heat liberating capacities that meet all requirements.

AIR HEATERS. B&W Tubular Air Heaters are inherently tight and efficient, and are easy to keep clean. Available in multi-pass gas flow type, as shown, or longitudinal gas-flow type, and in sizes to meet the requirements of any boiler installation.

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Offset Dead End Sleeves

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From dam site to drawing room...

with wire insulation made from Geon

WIRE insulation made from GEON polyvinyl raw materials will have almost universal application just as soon as restrictions on its use are lifted. A greatly expanded knowledge of compounding, derived from a research program accelerated by war needs, has resulted in a large group of special-purpose insulating materials which are being supplied to wire manufacturers for essential applications.

The pictures indicate the wide range of applications—from shot-firing wire to lamp cord. In between there is a long list of uses in industrial and domestic construction, communications, manufacturing of all kinds, transportation, public utilities and every other industry in America.

The list of properties of insulating material made from GEON is headed, of course, by outstanding electrical properties. Following is a long list of normally destructive factors which compounds made from GEON can be designed to resist; oils and greases, water, air, aging, sun, abrasion, flame, chemicals and many others. GEON has certain limitations, of course. For example, being a thermoplastic material, insulation made from GEON cannot yet be used on wire for certain types of heating units such as toasters, roasters, irons or home heaters. But current research indicates that these applications may soon be included in the list.

Right now all the GEONS are subject to allocation by the War Production Board. Limited quantities may be had for experiment. And our development staff and laboratory facilities are available to help you work out any special problems in connection with essential applications.

For more complete information, write Department CC-6, B. F. Goodrich Chemical Company, Rose Building, East 9th and Prospect, Cleveland 15, O.

Geon
Polyvinyl Materials

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COMING HOME TO ROOST

A 1,000-MILE MISSION—safety dependent on recognition by friends and identification of foes. Courage and prayer, skill and a crystal, have brought him back — a crystal that controls communication between our units by means of pre-arranged wavelengths. And protecting this crystal from moist salt air, preventing its clouding or "crazing" — guarding, too, the sensitive metal contacts from corrosion — is a tiny black holder molded from BAKELITE phenolic material BM-7156.

The U. S. Signal Corps found that BAKELITE BM-7156 offered far more resistance to moisture permeation than other molding compounds for this vital application. Designers and product engineers, likewise, will find BM-7156 outstandingly serviceable for instrument housings and covers, wherever delicate electrical conductors must be kept corrosion-free. Besides moisture resistance, BAKELITE BM-7156 provides lightness in weight, chemical resistance, dimensional stability, and good electrical qualities.

Write for copy of Booklet 47P, "A Simplified Guide to BAKELITE and VINYLITE Plastics." It describes and illustrates the great variety of plastics and resinous products offered by Bakelite Corporation for the solution of diversified product design problems.

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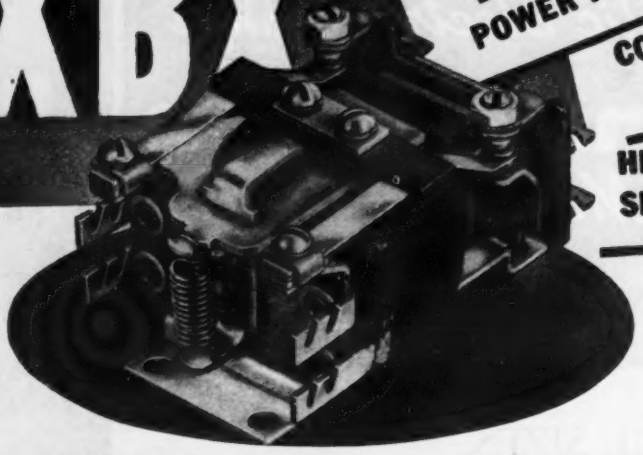

DELIVERS A LOT OF POWER FOR ITS SIZE

COVERS A WIDE RANGE OF APPLICATIONS

HIGHLY RESISTANT TO SHOCK AND VIBRATION

. . . A GOOD RELAY TO KNOW!

If any Relay type ever deserved the name "All-Purpose" it is Type 10XBX of the Struthers-Dunn 10-frame series. While new and special types come and go, this popular 2P. D.T. relay continues in heavy favor with leading users to whom its extreme versatility on a wide range of applications holds strong appeal. From audio frequency circuits to motor control circuits; from naval battle announcing stations where shock resistance is important, to aircraft use where vibration is a big factor, 10XBX relays are performing competently and well.

These relays are light, small, and sturdy. Highly electrically efficient, they deliver a lot of power for their size. Contact pressures up to 50 grams are available. Bakelite insulation is supplied for power circuit applications, and ceramic insulation for radio-frequency use. A-C coils to 115v, 60 cycles; or d-c coils to 115v are available. Contacts may be in any desired combination up to and including 3 pole, double throw. All 10XBX relays withstand 10G vibration and are highly resistant to shock. Other relays of the 10-frame series are available in either single or three pole contact arrangements.

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Easier Installation

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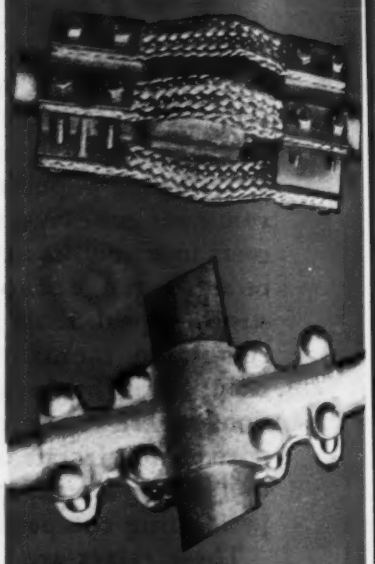
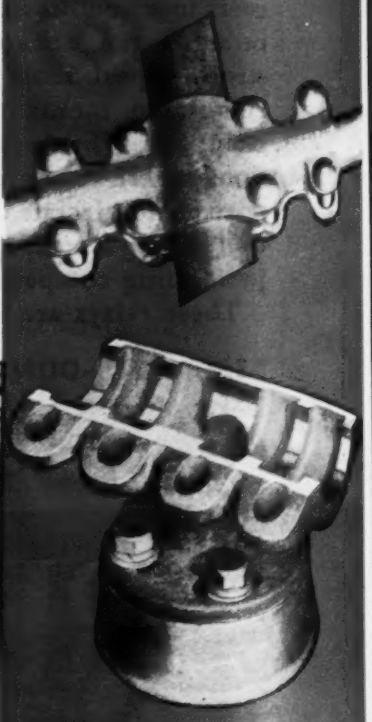
Made in ALL SIZES, ALL TYPES

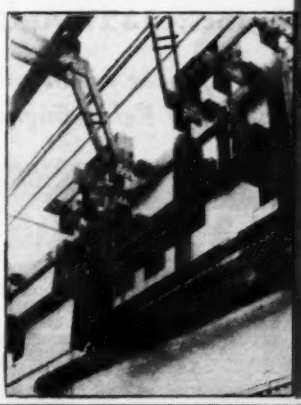
Carefully-matched sections, assembled with all nuts and bolts, assure easier installation of the bus fittings made by the Pacific Electric Mfg. Corporation. The careful machining and grinding give perfect contact while our special copper alloy gives unsurpassed strength and long life even where atmospheric conditions are severe.

Thus you are assured of low-cost installation and maximum current-carrying ability when you select these bus fittings which are carefully made by skilled craftsmen. That is why so many utilities reorder again and again.

Ask for full details about Pacific Electric bus fittings that are made in all sizes and all types.







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LOW-RESISTANCE CONNECTIONS FACILITATE USE OF ALUMINUM AIRCRAFT CABLE!

Tests on New Burndy Method show high electrical and mechanical efficiency

One of the drawbacks which has seriously retarded the use of small-sized aluminum cable for electrical conductors has been the difficulty of making reliable, permanent, low-resistance connections. This is due principally to the tenacious, transparent film of aluminum oxide ordinarily present on the metal. The oxide not only causes extremely high contact resistance between the outer cable strands and the connector contact surface, but it also causes high transverse resistance from strand to strand within the cable itself.

Public utilities and other users of large-size aluminum conductors have solved this problem by coating contact surfaces with a protective compound and then scratch brushing to break up the oxide film. This method is impractical, however, with small cables which have a large number of small strands, and where the connectors used have small barrels.

Table showing effect of treatment on connection resistance

Treatment of Terminal Contact Surface	Method of Using Compound Filler	Resistance in Microhms		Relative Conductivity, %
		Connection Resistance	Equal Length Cable	
None	None	136.41	81.74	59.8
Zinc-flashed	None	91.92	81.74	88.9
Zinc-flashed	Contact surface compound coated	78.75	81.74	103.8
Zinc-flashed	Compound forced between cable strands	69.57	81.74	117.5

A Practical, Efficient Solution

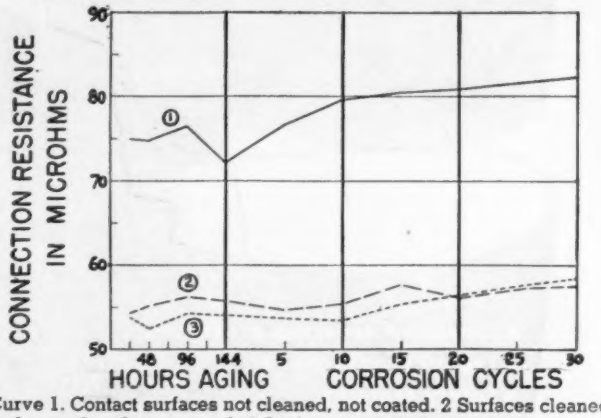
Intensive research on this problem by Burndy Engineers, has resulted in aluminum connectors which provide connections not only permanent and high in electrical efficiency, but also practical from the standpoints of convenience and over-all costs. In fact, installation procedure remains identical with the present rapid method of indenting small wire connectors with a Burndy Hytool.

In manufacture, the surfaces of these new Burndy aluminum connectors are etched chemically, and while the oxide-free surfaces are still wet, they are zinc flashed, and later plated with zinc to provide a mechanically strong coating. Thus, the reformation of the oxide film is prohibited.

The barrel of each zinc-plated connector is then filled with a special compound of zinc dust suspended in petrolatum jelly. Thus, when the cable is inserted into the zinc-compound-filled barrel, and the connector is indented to the cable with a Burndy Hytool, the compound is forced down between the strands of the cable. This breaks through and disperses the oxide film on the individual strands, and prevents further formation of oxides or other products of corrosion.

As will be noted from the table, the electrical conductivity of the finished connection is practically double that of an ordinary non-treated aluminum connection.

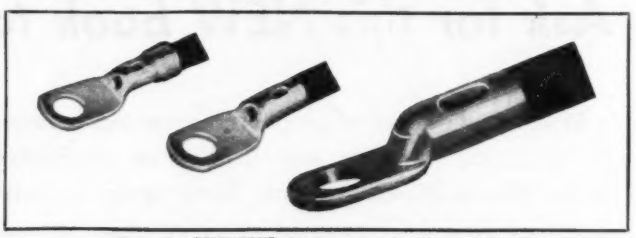
Effect of corrosion on electrical resistance of connections



Curve 1. Contact surfaces not cleaned, not coated. 2 Surfaces cleaned and coated with compound. 3 Surfaces zinc flashed and coated with compound.

The curve shows clearly the ability of these new Burndy connectors to maintain a low resistance after exposure to corrosive agents.

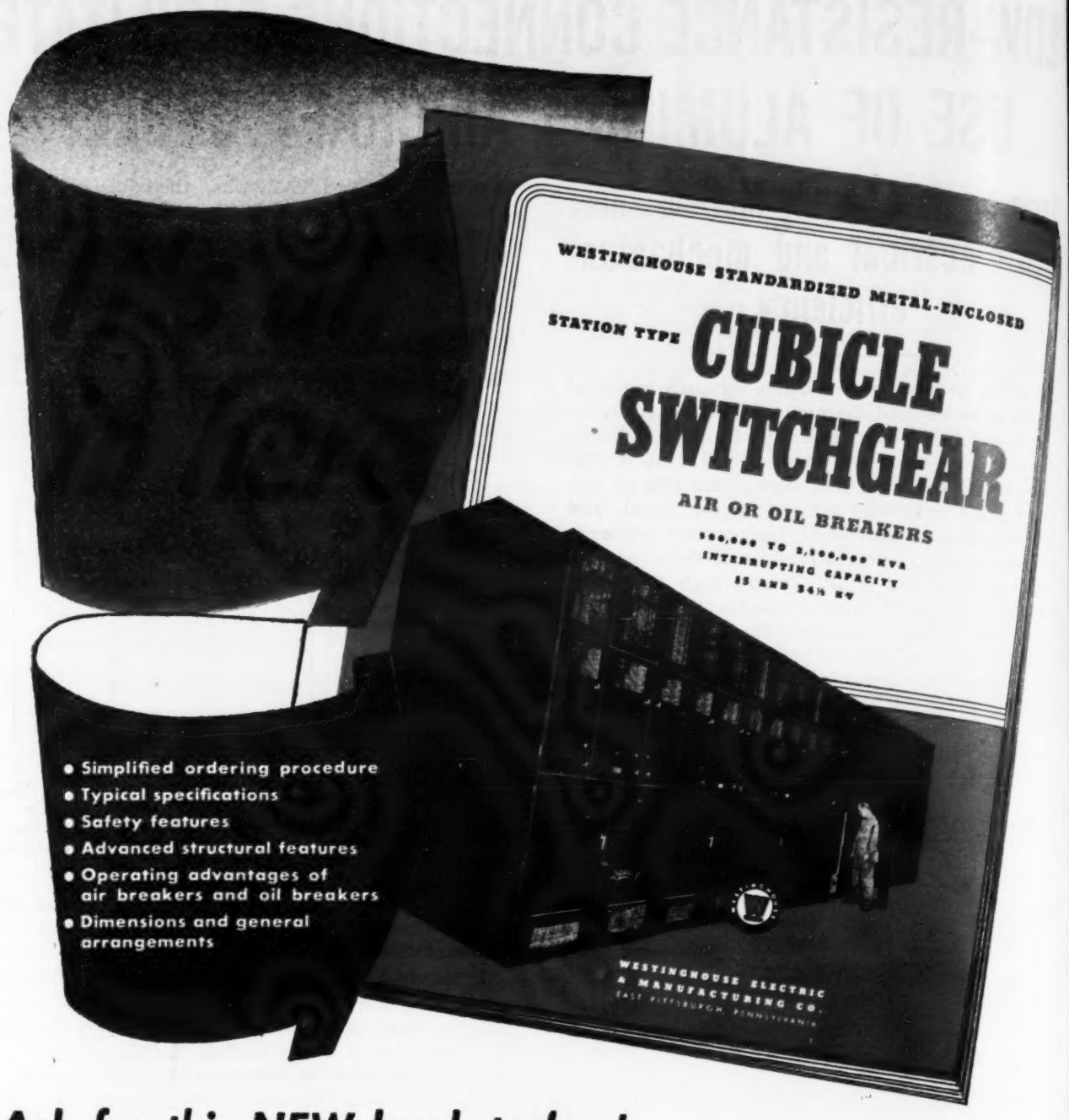
It should be remembered, however, that the most satisfactory method of connecting aluminum cables is by the longitudinal indent method. For only this type of indent forces the individual strands to shift and rearrange themselves, thus exerting a wiping action on each other which helps to remove the oxide film.



Burndy HYDENT (indent-type) Connectors

Laboratory Report Available

A complete laboratory report on this new Burndy method of connecting aluminum aircraft cables has been prepared and copies can be secured by writing to Burndy Engineering Company, Inc., 107-J Bruckner Blvd., New York 54, N. Y.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Ratings of Station Type Cubicle Switchgear range from 500,000 to 2,500,000 kva interrupting capacity, 7½ to 34½ kv.

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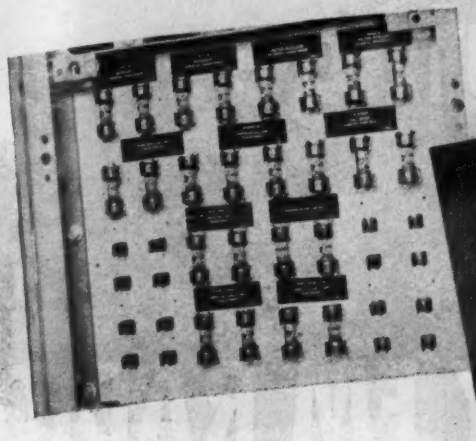
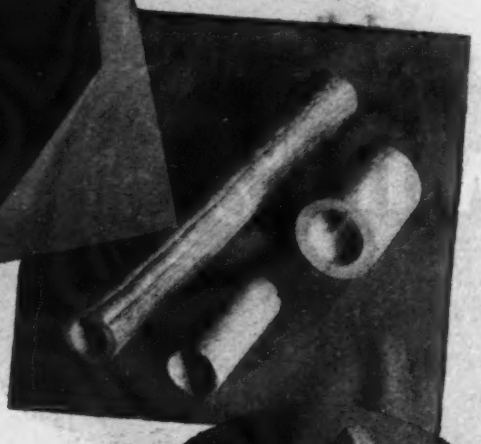
CUBICLE SWITCHGEAR

MELMAC glass-fiber laminated insulation is installed as panel or switchboard material for mounting fuses, instruments, and other electric equipment.



In sheet form, these laminates have been produced in thicknesses from 1/32" to 2" for panel and switchboard material.

Glass cloth impregnated with MELMAC resin can be molded into rods or tubes for use as sleeves and other electrical insulating products.



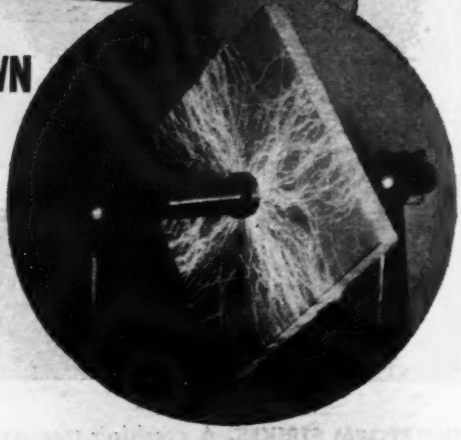
New Melmac GLASS-CLOTH LAMINATES GUARD AGAINST ELECTRICAL BREAKDOWN

A new laminated insulation material, made of glass-fiber cloth with Cyanamid's MELMAC* 402 laminating resin, is now being specified by the Navy Department Bureau of Ships because it will not support combustion, it has superior arc resistance and high impact strength.

It is employed as an insulating material for Naval electric equipment, including power, lighting, interior communication, fire control, and ordnance applications for shipboard installations. It is also specified for coil spacers, pole collars, slot wedges, and similar insulation in rotating electrical equipment.

Have you an application where MELMAC glass-cloth laminates, with such an unusual combination of electrical and mechanical properties, will be of particular importance? Write us for further information.

*Reg. U. S. Pat. Off.



Exposed to 60,000 volts for 3 minutes, this 3/8" laminated panelboard showed no carbon tracking or other electrical deterioration.

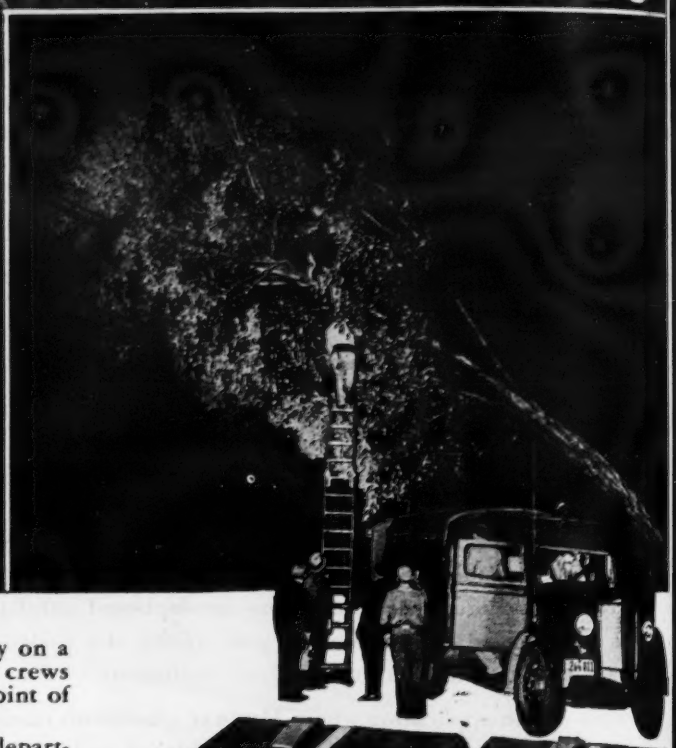
MELMAC fiber-glass cloth laminates will not support combustion, or give off toxic gases, even though subjected to a high temperature for many hours.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA • NEW YORK 20, N.

Cyanamid Plastics
Beetle · Melmac · Melurac
Laminac · Urac

Reduce outage...

with G-E 2-WAY FM RADIO



THE STORM STRIKES. A crashing tree weighs heavily on a feeder. The night dispatcher calls the maintenance crews nearest the affected area and within minutes each point of potential danger is located and isolated.

G-E 2-way FM radio can help your maintenance department reduce outage. It will provide a sure means of instantaneous communication between dispatcher and field crew and between each field crew and every other. It will enable the same maintenance crews to serve wider areas. It will definitely lower service costs.

Government regulations now permit new installations of 2-way FM radio for important requirements of utility companies. Let your General Electric representative help prepare your applications.

Ask your G-E sales engineer how G-E 2-way FM radio can improve communication in your particular system. He will be glad to discuss your problems and have a specialist assist in planning the most effective and economical installation for your needs. *Electronics Department, General Electric Company, Schenectady 5, New York.*

Everything for 2-Way Radio

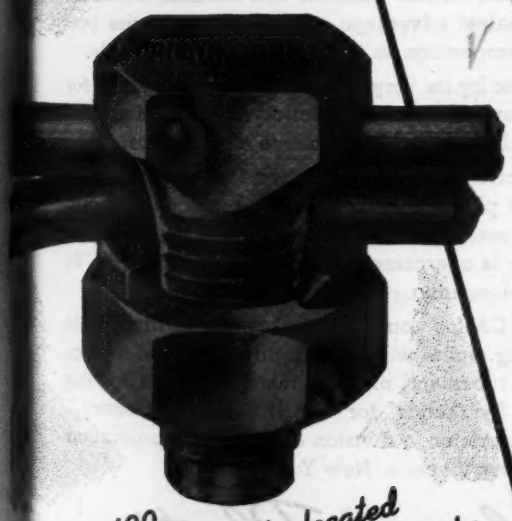
GENERAL ELECTRIC

183-D12-6918

Check These 7 Advantages of BLACKBURN Hi-Strength CONNECTORS!

- They're the strongest and most durable connectors made. That's because they're the only complete line of connectors made of DURONZE, which tests show is 75% stronger than hard-drawn copper, and more non-corrosive than pure copper.
- Because of this exclusive high-strength construction, BLACKBURN CONNECTORS will not distort, and can be used over and over again —a real economy.
- Conductivity of the joint is actually better than the solid wire itself.
- Reinforced pressure bar makes a strong connector still stronger.
- All corners rounded—will not nick wires or cut lineman's glove.
- Machined to close tolerances, assuring accurate fit of nut and maximum strength of thread.
- Full threads on screw for maximum strength.

In short, BLACKBURN Hi-Strength CONNECTORS are trouble-free on the line, and definitely cut your maintenance expense. Yet they cost no more than ordinary connectors.



Over 100 Conveniently-located Jobbers' Stocks

BLACKBURN Hi-Strength CONNECTORS

Builders of Quality Connectors for Over 10 Years

JASPER BLACKBURN PRODUCTS CORP.
Main and Clinton Sts., St. Louis (6), Mo.

THE BLACK HAND OF CORROSION SHACKLED BY LUMARITH* CA

For more effective electrical insulation—typical applications of Lumarith CA:

Turn insulation for magnet wire
Major coil insulation
Coil lead insulation
Boot and pad insulation
Layer wound cores for coils
Slot insulation
Laminated to paper, cloth, mica, etc.
Backing for pressure sensitive tape
Spiral wound for cables and spun-end grommets

EXECUTIVES! Just published, 136 page manual entitled, "FABRICATING METHODS FOR LUMARITH* CELLULOID* AND SIMILAR THERMOPLASTIC MATERIALS." Write for complimentary copy on your company letterhead. Additional copies, $1.00 each.
*Reg. U. S. Pat. Off.

APPLICATIONS of Lumarith CA (cellulose acetate) to fine gauge copper wire—1 and 2 mil—stress the inherent advantages of this cellulosic base insulating material.

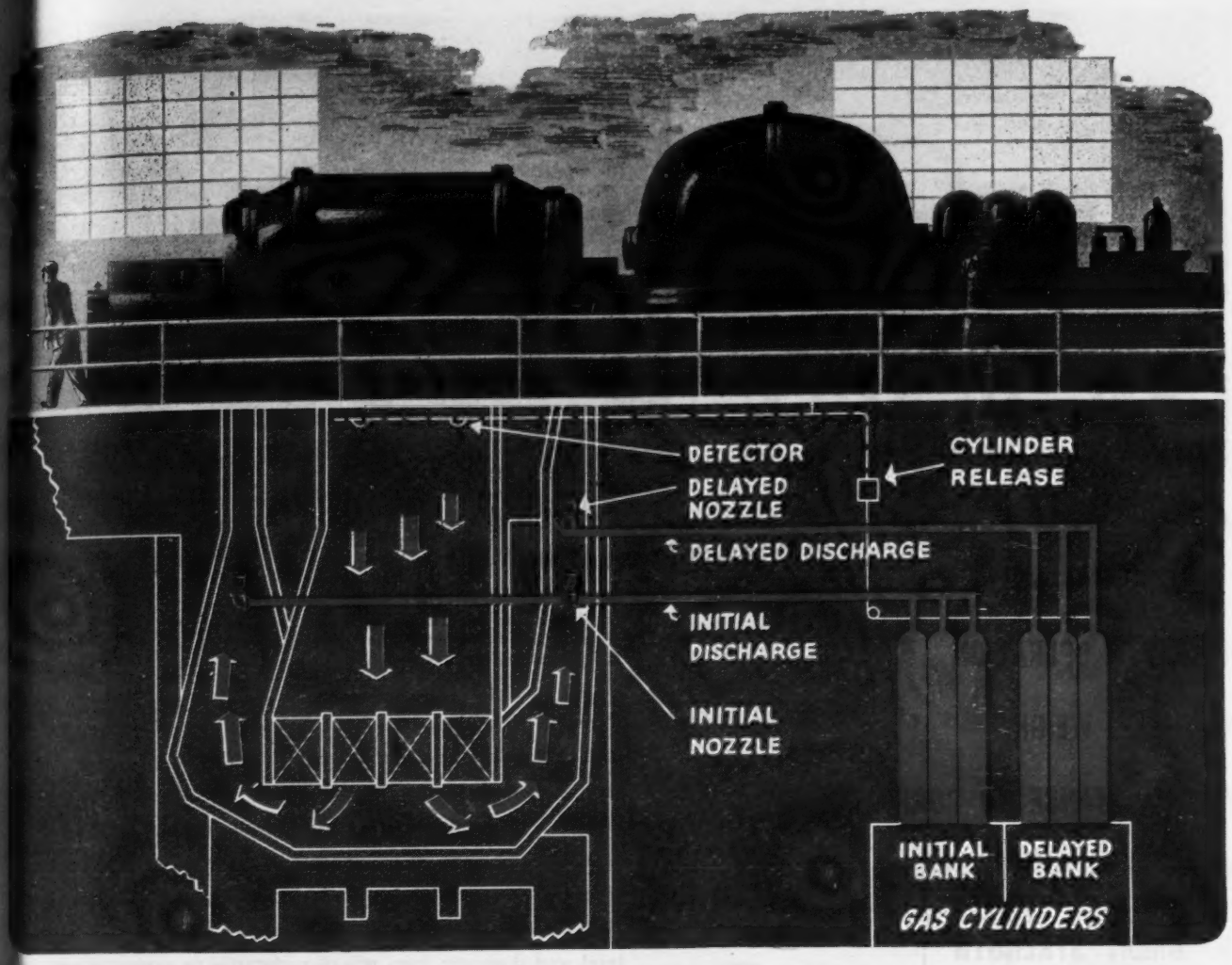
Here, where corrosion strikes quickest and hardest, Lumarith CA shows to the greatest advantage its freedom from the tendency to organic decomposition so inherent in many materials.

Rather, this synthetic by its very nature is chemically inert, for example, to transformer oil, and to the electrolytic action of humidity, moisture—even salt water in the presence of direct current.

The in-built dielectric strength and chemical resistance of Lumarith CA, and its physical resistance to abrasion, cracking, crease-breaks, is impressive even with the thinnest foil. Slippage in winding and usage is overcome by a special mat finish (A78) which also increases elongation, requires no lubricants.

Look into Lumarith CA for *your* electrical needs. In films, foils for winding, laminating. Spiral wound for light yet rugged tubing. Rods, sheets, regular tubes and molding materials. Send for the booklet, "Celanese Synthetics for the Electrical Industry." Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Avenue, New York 16, N. Y.

A Celanese Plastic*



It knocks out fire with a one-two punch!

A short in a generator? Watch the Kidde Built-in System take on the fire-fighting job.

Thermostats or differential relays act swiftly to shut down the machine and unleash the fast, safe fire-extinguishing agent—carbon dioxide gas.

First, a heavy discharge of the gas pours into the machine, swirling around obstructions, penetrating into windings—*to kill flames instantly.*

Then, additional gas is released to maintain an inert atmosphere while the machine is running down—*preventing glow from rekindling.*

When generators are protected by Kidde systems, damage is confined to the point of rupture. There is no softening of insulation or water-soaking of equipment. Down time is reduced to a minimum.

There are other types of Kidde equipment—portable, wheeled units, and systems—for the protection of other commonly encountered fire hazards in the public utility field. Check the accompanying list of danger spots—then ask a Kidde representative to assist you in selecting the best protection for each of them.

* * *

KIDDE KILLS TOUGH FIRES *in Generators, Motors, Condensers, Transformers, Switchgear, Lightning Arrestors, Rectifiers, Regulators, Flammable Liquid Storage, and Oil Lubricant Recirculation.*

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc. • 140 Cedar Street, New York 6, N. Y.

PANELYTE*

PRECISION-MOLDED FAN BLADES

GIVE YOU THESE 9 ADVANTAGES:

Panelyte Blade (62" long — 14½" wide) mass-produced for Hartzell Propeller Fan Company, Piqua, Ohio, being removed from mold.

1. QUIET OPERATION
2. LIGHT WEIGHT
3. RESISTANCE TO CORROSION
4. LOW MOISTURE ABSORPTION
5. GREAT STRENGTH
6. STABILITY UNDER TEMPERATURE CHANGES
7. LOWER STARTING CURRENT URGE
8. REDUCED BEARING LOADS
9. TROUBLE-FREE PERFORMANCE

Panelyte Fan Blades . . . from midgets 2" long to 62" giants . . . are precision-molded in straight line mass production. The unique combination of properties of these blades makes them ideal for the complete range of applications . . . from household fans, cooling fans in refrigerators and air-conditioning units where quiet operation is a major requirement, to blades such as those supplied for outdoor cooling tower fans and other industrial and domestic uses where resistance to corrosion and extremes of temperature are paramount.

The techniques perfected in the molding of aircraft propeller blades in wartime will produce better *fan blades* for peace time uses.

Panelyte engineers are ready to work with you . . . to discuss the design and mass production of fan blades or other molded or fabricated parts. Write for factual "Data Book."

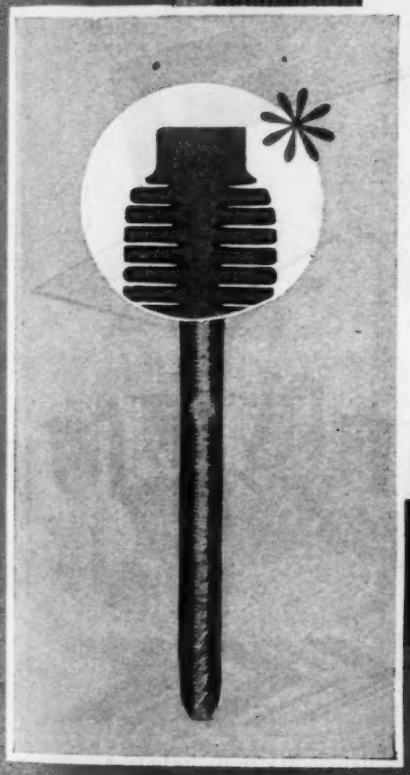
PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
230 PARK AVENUE
NEW YORK 17, N. Y.

Sales Offices: Atlanta, Boston, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Kansas City, Los Angeles, Mexico City, Montreal, New Orleans, Phoenix, Portland, St. Louis, St. Paul, San Francisco, Seattle, Syracuse, Toronto, Trenton, Vancouver.

* MASS PRODUCTION OF SHEETS, RODS, TUBES, MOLDED FORMS, FABRICATED PARTS IN PAPER, FABRIC, FIBRE GLASS, WOOD VENEER AND ASBESTOS BASE LAMINATES

THE GOULD *Plante'* PROVIDES FULL PLATE PERFORMANCE THROUGHOUT BATTERY LIFE!

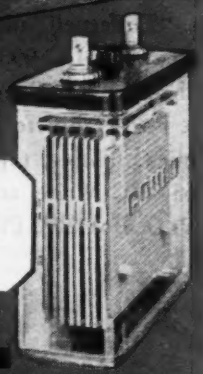


In Gould Plante a dense film of positive active material covers the entire surface of the positive plate. This film, formed from the pure lead plate itself, protects the entire plate structure against further peroxidization or disintegration.

No holding structures are necessary. The plate, being of one-piece construction, is assured the longest possible life. It is not subject to partial deterioration resulting in loss of capacity.

One-piece, pure lead positive plates, ribbed to increase surface area, are an exclusive Gould development. They make the Plante battery definitely superior for all standby and control operations.

Gould also builds two other types of stationary batteries, Kathanode and Dreadnaught. Write Dept. 176 for Catalog 1000 on Gould Sealed-in-Glass Batteries for Stationary Applications.



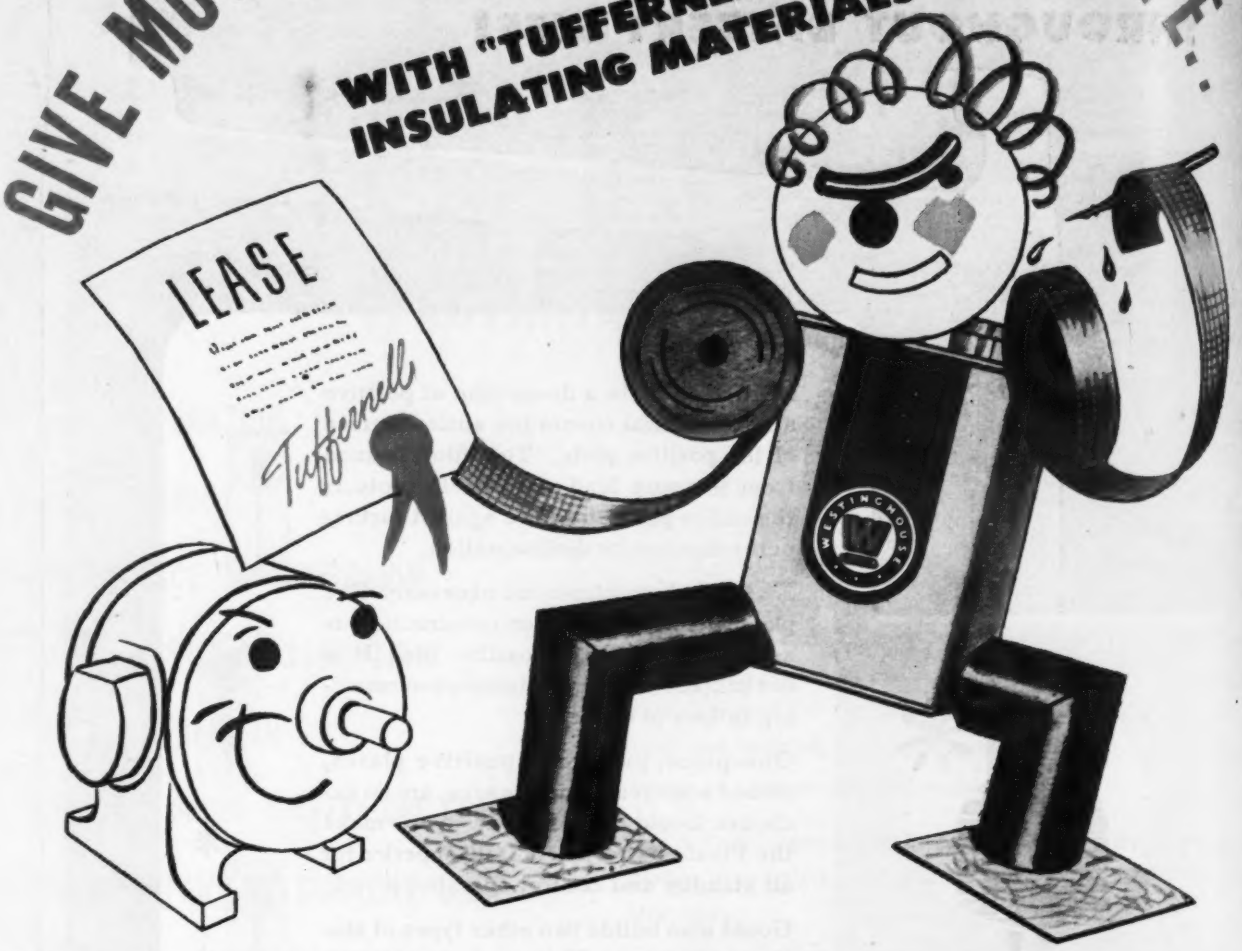
GOULD *Plante'*

PURE LEAD FOR LONGEST LIFE

GOULD STORAGE BATTERY CORPORATION, Depew, N. Y. Factories Atlanta • Chicago • Dallas • Depew • Leavenworth • Los Angeles • North Bergen • Rock Island • Saint Paul • Sioux City • Zanesville

GIVE MOTORS A LONGER LEASE ON LIFE..

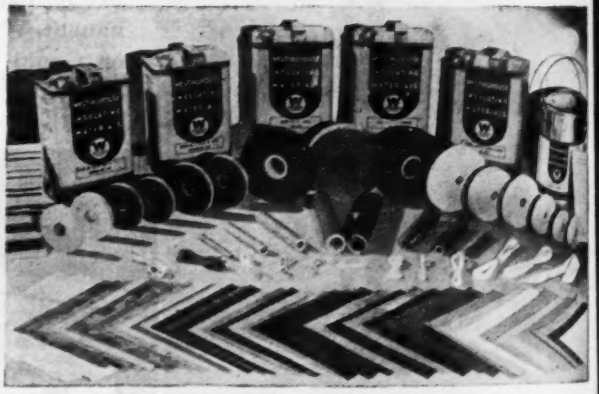
WITH "TUFFERNELL" INSULATING MATERIALS



Now is the time to make sure that your electrical apparatus will give added years of service . . . without interruption . . . and at competitive efficiency. So, for choosing the correct insulation ask your Westinghouse Distributor about "Tuffernell" . . . a complete line of insulating materials.

"Tuffernell" includes all the usual insulating materials as well as DC-993, a varnish belonging to the sensational chemical family of silicones.

For complete dimensions and application data on mica, fabrics, tapes and papers, get a copy of Catalog 65-000. Write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-06366

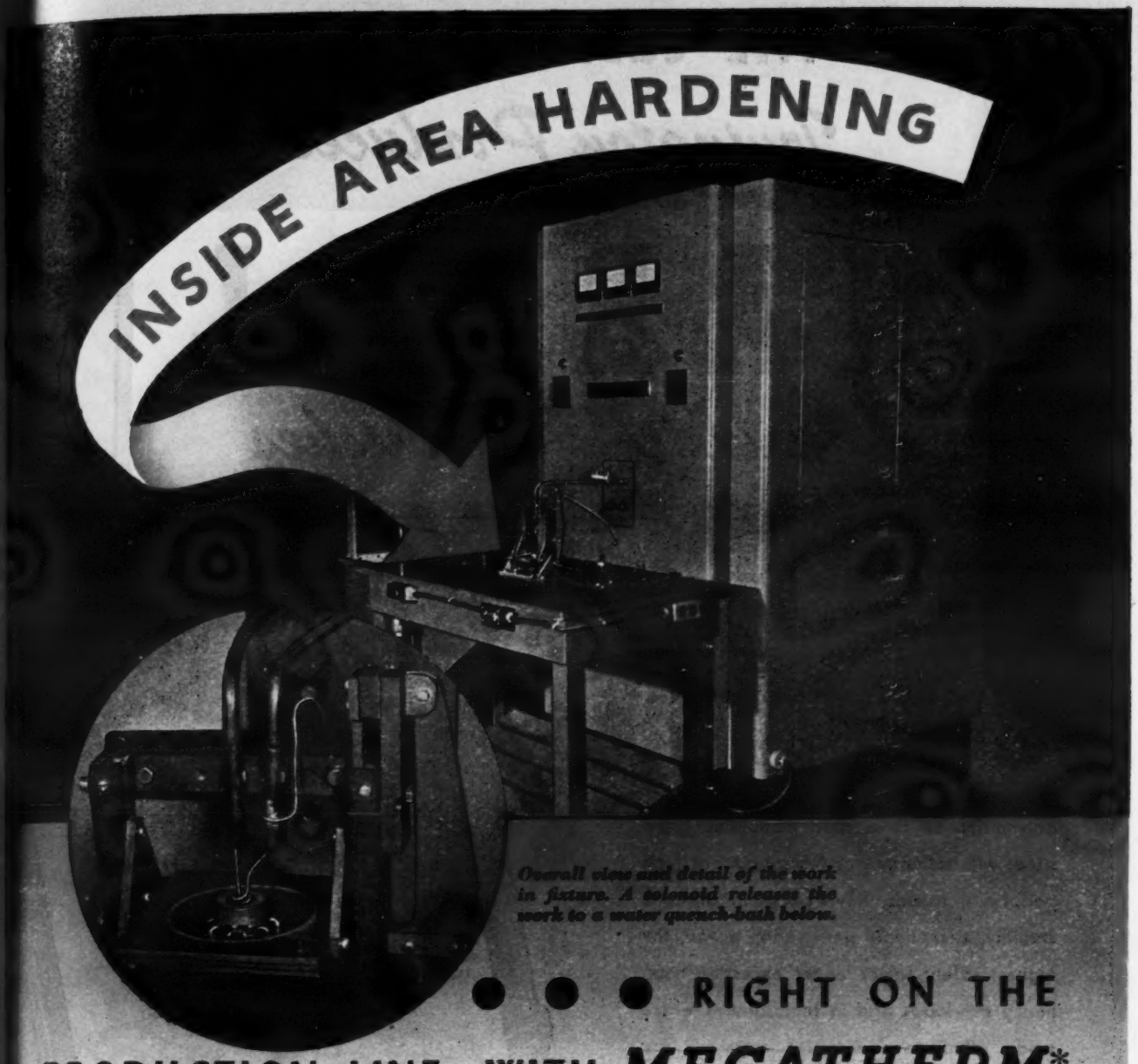


Westinghouse Insulating Materials include a complete line of micas, fabrics, tapes, papers and varnishes.

Westinghouse

Insulating Materials

INSIDE AREA HARDENING



Overall view and detail of the work in fixture. A solenoid releases the work to a water quench-bath below.

● ● ● RIGHT ON THE PRODUCTION LINE—WITH *MEGATHERM**

In just six seconds Megatherm electronic heat hardens the inside surface of this sheave hub, controlling the hardened depth to vary from .125" at the rims, to .030" at the center.

Moreover, this hardening is accomplished without affecting the toughness of the surrounding metal.

To enable the Kimberly-Clark Corporation to successfully harden this hard to reach part, FTR engineers assisted in solving the problem through the use of megacycle energy.

Megatherm delivers the heat... when you want it... where you want it... *FAST.*

And Megatherm is versatile... will heat treat a wide range of irregular shapes and surfaces... shafts, bearings, cams, gear teeth, lever ends... and in hard-to-reach places.

Write to Dept. M for help on *your* heating problem.

Black area illustrates controlled variation in depth of hardening from .030" to .125", 40-45 Rockwell-C.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

*Reg. U. S. Pat. Off.

OUT OF THE cashew NUT SHELL . . .

Irvington Produces

HARVEL

Insulating Varnishes

TOUGH as the combined strength of Armor Plate, Elephant Hide and Walrus Back.

Irvington's HARVEL Insulating Varnishes, for baking or air drying applications, cure by polymerization to a solid monolithic fused state, will not soften or "throw-out" at high peripheral speeds, have excellent dip-tank stability, exceptional penetrating power, the highest safety factor under excessive heat, heavy overloads and in atmospheres where acids, alkalis and abrasive materials are present . . . and

HARVEL WILL NOT SUPPORT FUNGUS GROWTH

HARVEL
• cures to an infusible state which is non-thermoplastic
• will not soften or "Throw-out"
• has excellent dip-tank stability
• is stable, insuring constancy of electric properties
• has no objectional solvents that attack enameled wire
• bonds conductors into a compact unit-acting mass
• has exceptional penetrating power
• has excellent insulation value at high temperatures
• produces firm, tough, mechanically strong coatings
• does not give off corrosive fumes
• resists acids, alkalis, oils and moisture
• imparts high thermal conductivity to finished coils
• is recommended for Fiberglas and Asbestos windings
HARVEL WILL NOT SUPPORT FUNGUS GROWTH

Write for your copy of the "HARVEL INSULATION DATA BOOK" and the MITCHELL-RAND "GUIDE BOOK" OF ELECTRICAL INSULATIONS.

MITCHELL-RAND for 56 YEARS THE ELECTRICAL INSULATION MANUFACTURERS EST. 1889

MITCHELL-RAND INSULATION COMPANY, INC.

51 MURRAY STREET COrtlandt 7-9264 NEW YORK 7, N.Y.

Transformer Compounds
Friction Tape and Splice
Cable Filling and Pothead Compounds
Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines

A PARTIAL LIST OF M-R PRODUCTS

Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types
Extruded Plastic Tubing

How small strips of *Nichrome protect EQUIPMENT WORTH MILLIONS

From simple home refrigerators to giant industrial equipment Electric Thermal Relays like this one protect machines worth millions against damaging overloads. In these applications the heating action of special resistance units trips switches—cuts off power supplies at predetermined danger points.

Ranging in form from plain wire wound units to specially formed strips, these "Heaters" must generate heat to simultaneously duplicate the rate and cycle of overload heating in the electrical equipment being guarded. Also they must resist the full impact of direct shorts, until other protective devices operate.

To meet these severe requirements, Nichrome, made only by Driver-Harris, is used, for this is the alloy that possesses high thermal retentivity combined with excellent heat and corrosion resistance.

Typical of the heavy-duty Thermal Overload Relays employing Nichrome is this 90 ampere, 600 volt Push-Button-Reset type which guards large Rolling Mill equipment in a steel plant. The right "Heater" has been removed to expose the thermal tripping mechanism.

If such dependable protection interests you why not investigate Nichrome and the 80 other Driver-Harris alloys. Write for further facts today.

D H
SPECIAL PURPOSE ALLOYS SINCE 1919

Driver-Harris
COMPANY
HARRISON, N. J.

Branches: Chicago • Detroit • Cleveland
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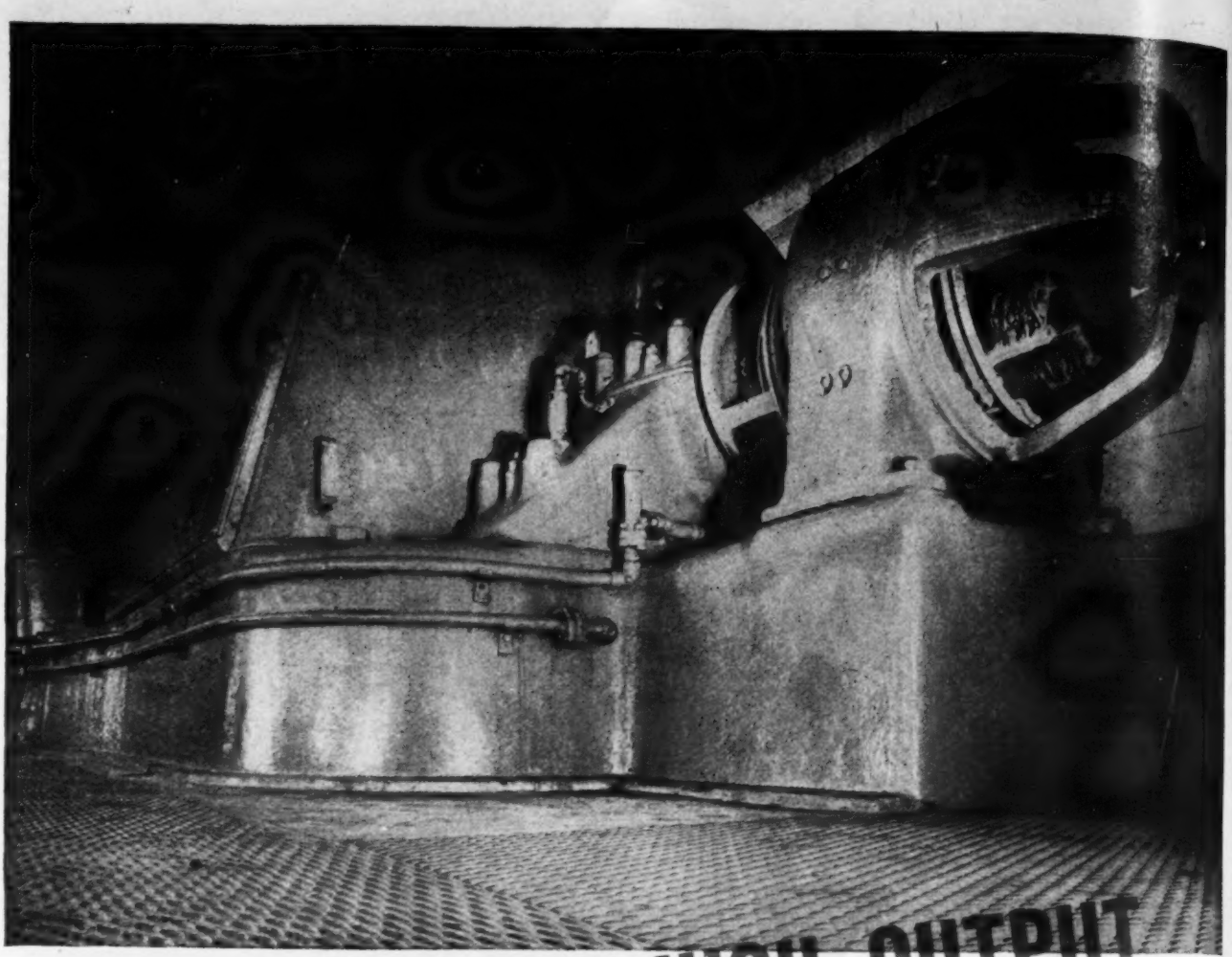
*Trade Mark Reg. U.S. Pat. Off.



MAINTAINING HIGH OUTPUT

ENGINEERS in both steam and hydro plants know that air, water and heat in turbine lubricating systems are troublemakers and may frequently cause shutdowns. Oils that maintain their lubricating ability under all conditions are necessary — *Texaco.*

Texaco Regal Oils (R & O), available for every type of turbine, are scientifically designed to prevent rusting of turbine lubricating systems. They are highly resistant to oxidation, foaming, sludging and gum formation. Because of these qualities, *Texaco Regal Oils (R & O)* keep turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. They fully meet specifications of all leading turbine builders and the turbine oil specifications of the U. S. Navy.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed at the right.

For suggestions on the proper care of oil and maintenance of turbine systems, call on Texaco Lubrication Engineering Service, available through more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ *More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.*

★ *More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.*

★ *More revenue airline miles in the U. S. are flown with Texaco than with any other brand.*

★ *More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.*

★ *More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.*

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL TURBINES

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON EVERY SUNDAY NIGHT — CBS

THERE'S GOING TO BE A BIG DIFFERENCE *Inside*

• According to the trend, a great many postwar homes are going to be built and sold with a lot of "built-in" features. Equipment and appliances, heretofore installed after the home was completed, are going to be provided as an integral part of the postwar home. Most of these will be electrical. Adequate wiring is the first important step in providing for these "built-in" electrical features. It is a factor that simply can't be overlooked.

The Square D Multi-breaker is a basic ingredient of adequate wiring. From the home owner's standpoint, it eliminates fuses completely—affords modern convenience and protection—makes it easy to add circuits as they are needed. From the Utilities' standpoint, it reduces service interruptions and costly service calls and builds valuable customer goodwill.

The Multi-breaker eliminates fuses completely. When a short circuit or dangerous overload occurs, the circuit is cut off automatically. A simple movement of the lever restores current after the cause of the overload has been removed. There are no delays—nothing to replace.

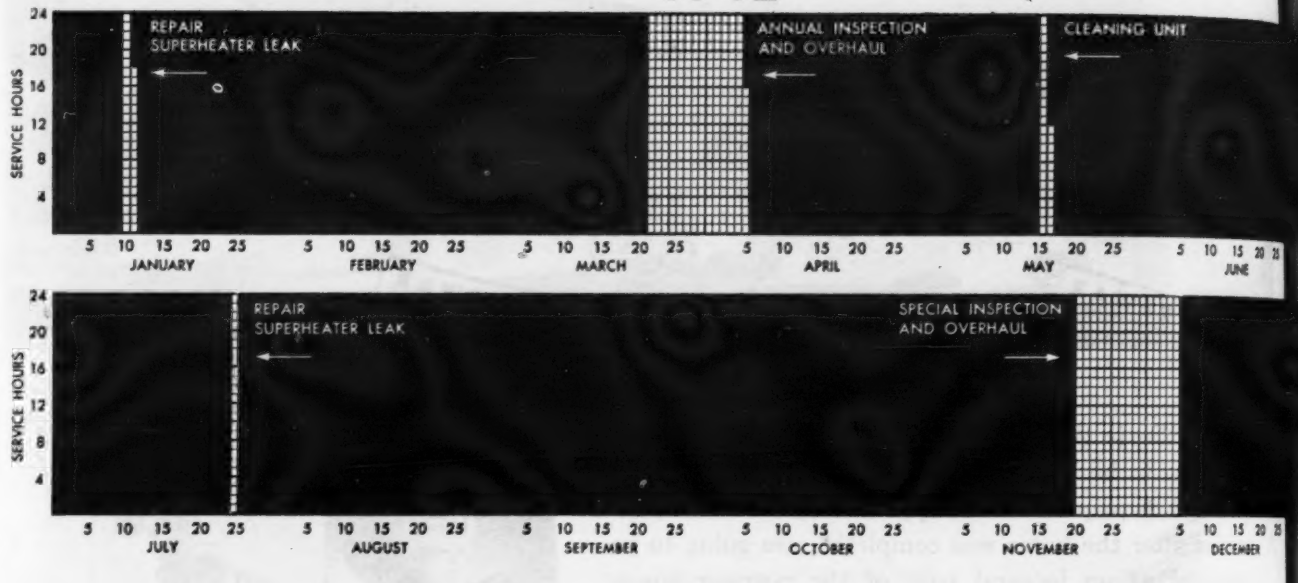
SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

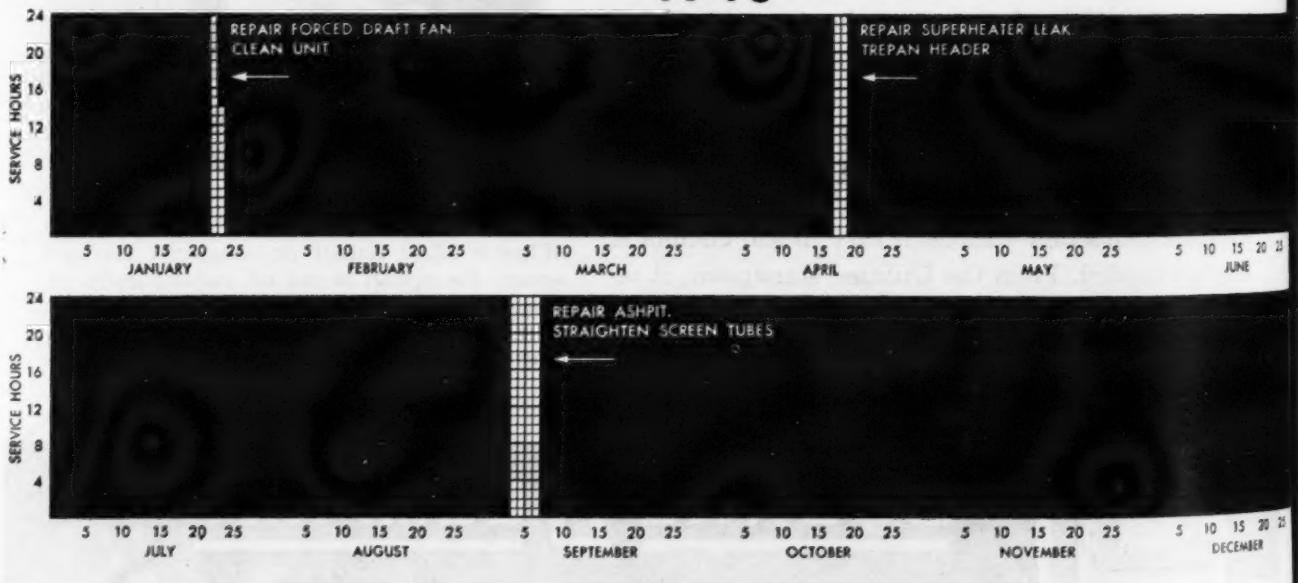
On the Line 93.6% of Total

OPERATING RECORD **The outage charts below and on the opposite page provide graphic evidence of the operating record of one of the world's largest steam generating units; a C-E Unit at the Logan, West Virginia plant of Appalachian Electric Power Company. This unit is designed to produce, at maximum continuous capacity, 1,000,000 lb of steam per hr at 1340 psi and 925 deg. F.**

1942

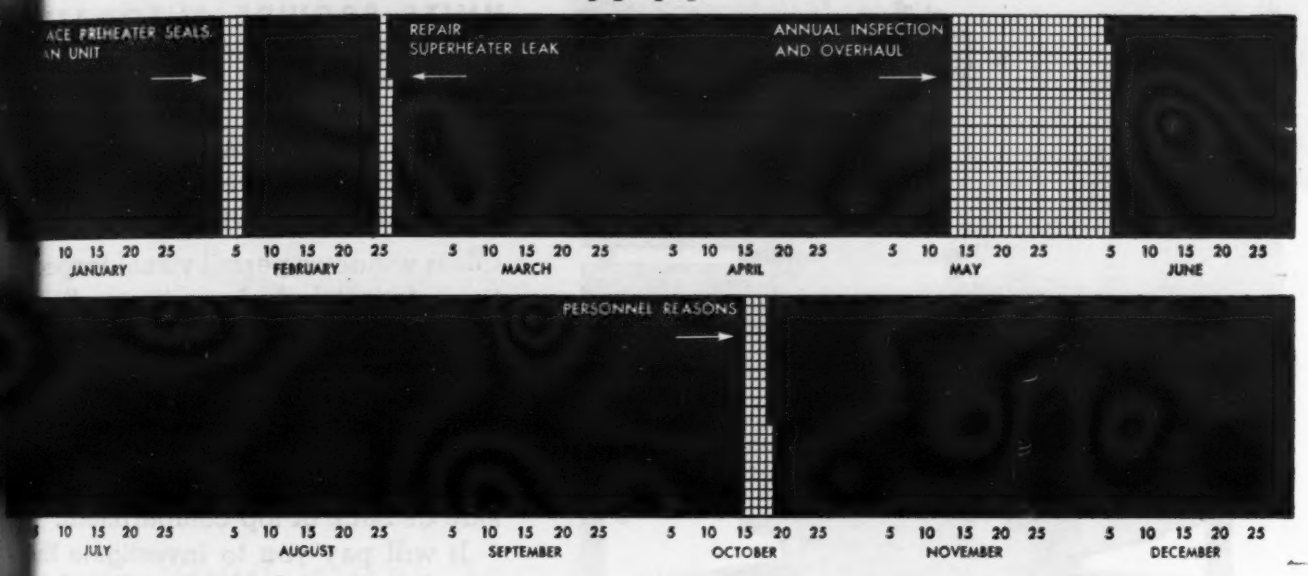


1943



Time for 3 War Years

at an Average Rate of 752,000 Lb of Steam per hr



3 YEAR USE FACTOR 93.6%

During three war years 1942, 1943 and 1944 this unit was in service for 93.6% of the entire period. Of the remaining 6.4% "out-of-service time", 4.6% was for scheduled annual inspection and overhaul. Only 1.8% was for other causes.

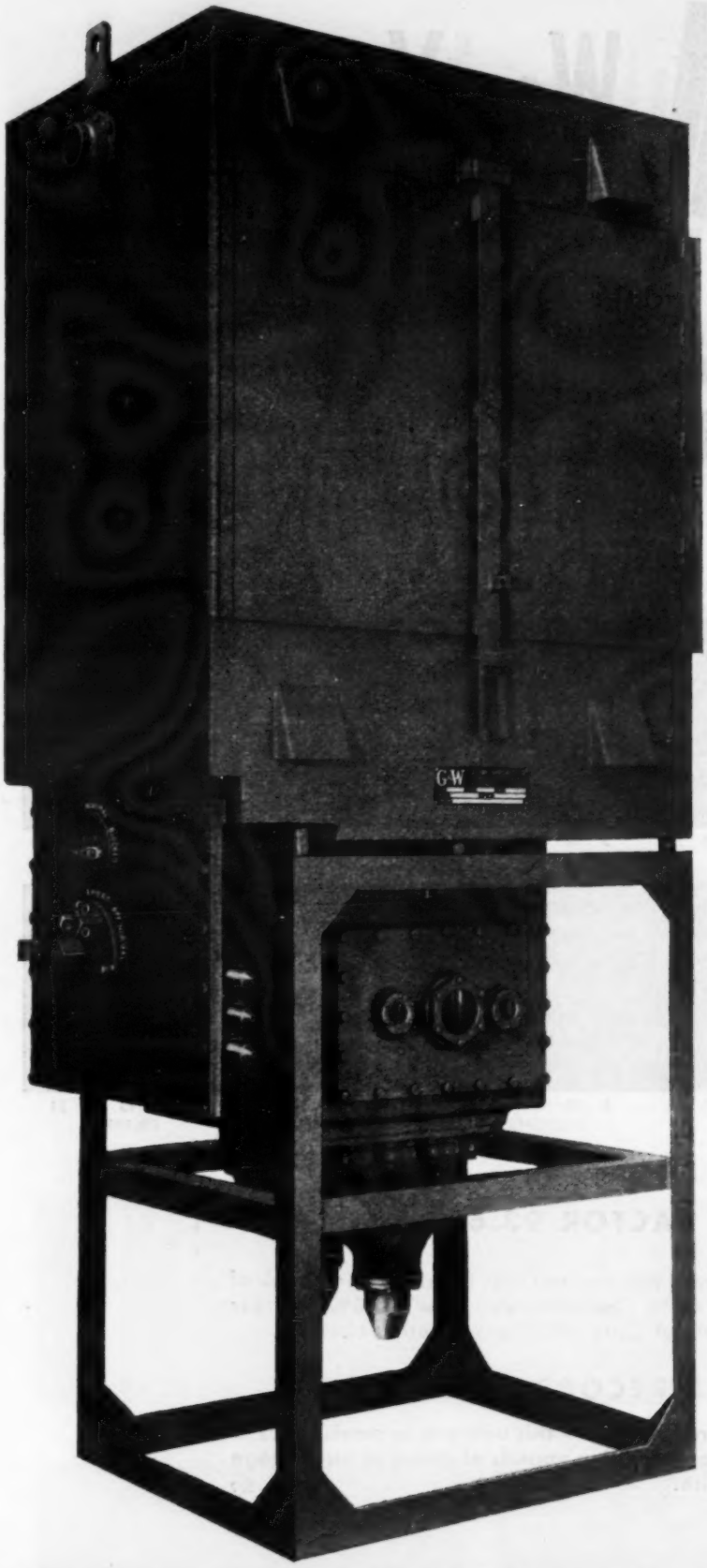
5 YEAR RECORD

During the five year period — 1940 through 1944 — this unit was in service 93.2% of all the time and produced more than 31 billion pounds of steam at an average rate of 766,000 lb per hr while in service.

A-879

COMBUSTION ENGINEERING

200 MADISON AVENUE NEW YORK 16, NEW YORK



15000 VOLT
AUTOMATIC TRANSFER
OIL SWITCHES
With Load Circuit Fuses in Upper Compartment

INSTALLED BY AN OIL REFINERY TO INSURE ELECTRIC SERVICE CONTINUITY

G&W TYPE "FRDA"

UNITS PROVIDE AUTOMATIC THROWOVER FROM NORMAL TO EMERGENCY FEED UPON FAILURE OF VOLTAGE ON THE NORMAL. MANUAL THROWBACK FROM EMERGENCY TO NORMAL FEED, MANUAL RESET OF MECHANISM.

Glass windows permit visual inspection of switch link positions. Feed cables terminate in potheads on bottom. Load outlet bushings within air filled compartment which encloses fuses. Connections to transformer through conduit on either side or back of top compartment.

It will pay you to investigate the possibilities of G&W Type "FDRA" Units for your distribution system. They are simple, practical and relatively inexpensive. They are made in the particular form that best fits local installation conditions.

Write us or get in touch with our representatives for further data.

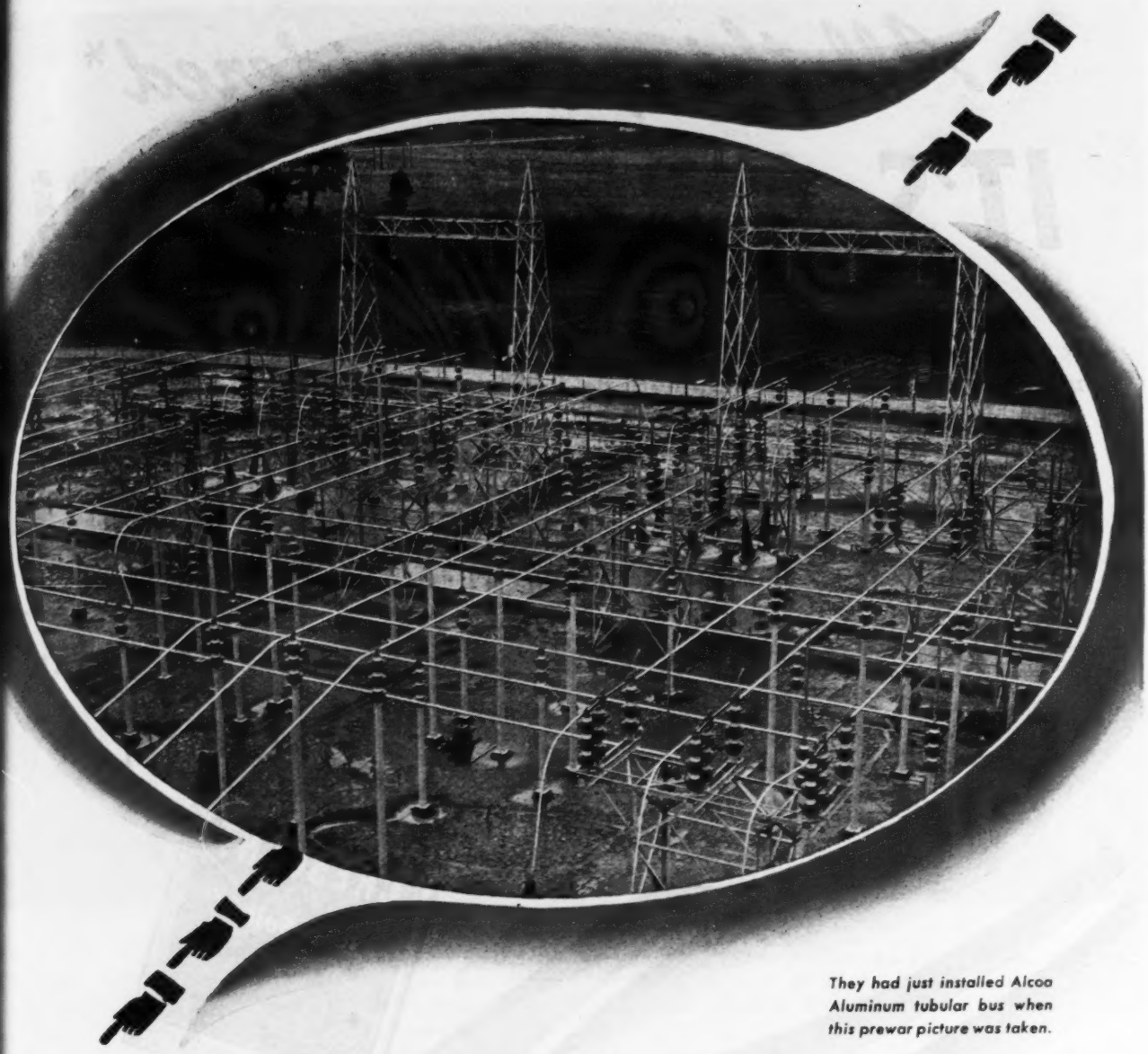
G&W ELECTRIC SPECIALTIES

Originators and pioneers of equipment for sound methods of underground and overhead electric distribution.

G&W ELECTRIC SPECIALTY CO.
7780 DANTE AVE., CHICAGO 19, ILL., U.S.A.

Potheads . . . Boxes . . . Oil Fuse Cutouts . . . Oil Switches . . . Multitaps . . . Splicing Kits

In Canada—Powerlite Devices, Ltd., Toronto, Canada



They had just installed Alcoa Aluminum tubular bus when this prewar picture was taken.

It's a good start for a substation

Yes, and it's a good way to keep it going, too. Alcoa Aluminum bus—tubular, flats, angles and channels—has proved its worth on every type of station, under all kinds of conditions.

This tubular aluminum bus is exceptionally light in weight. It is very rigid, so there's no unsightly sagging when supports are widely spaced; it can be easily formed to meet any requirements.

Alcoa Aluminum conductors of all types offer a high degree of electrical and thermal efficiency. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Bldg., Pittsburgh 19, Pennsylvania.

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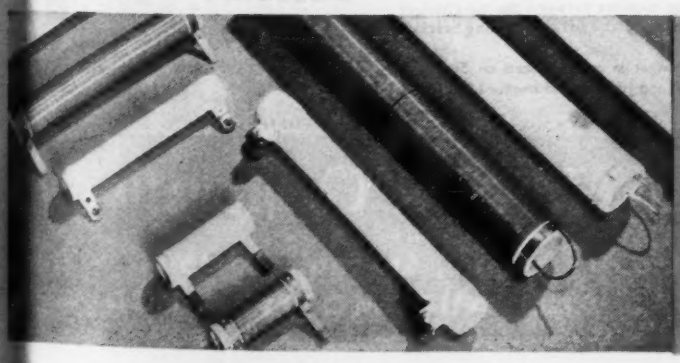

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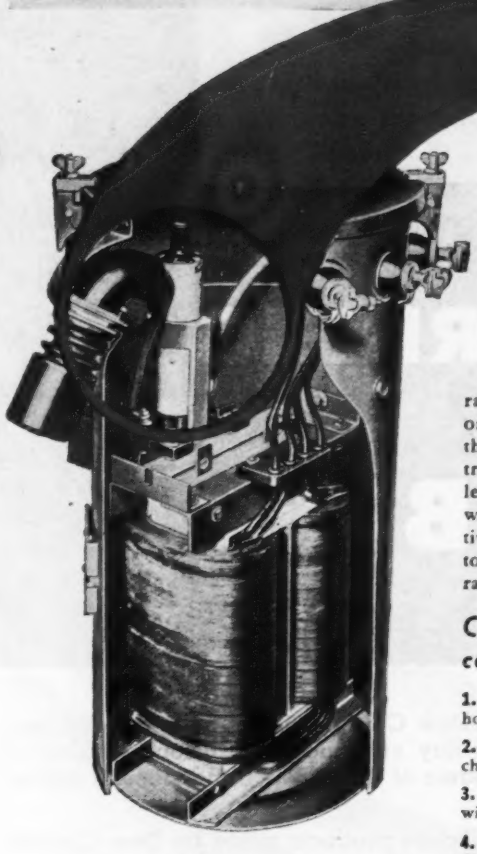

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7. Holes are provided so as to allow free circulation of oil.

8, 9, & 10. The movable contact assembly (**8**) is provided with a carefully designed spring (**9**) which exerts a predetermined pressure against the contact roller (**10**) so as to provide a positive contact between the bridged stationary contacts. This spring-set roller operates with a snap-action that assures correct position and positive contact for each tap selected.

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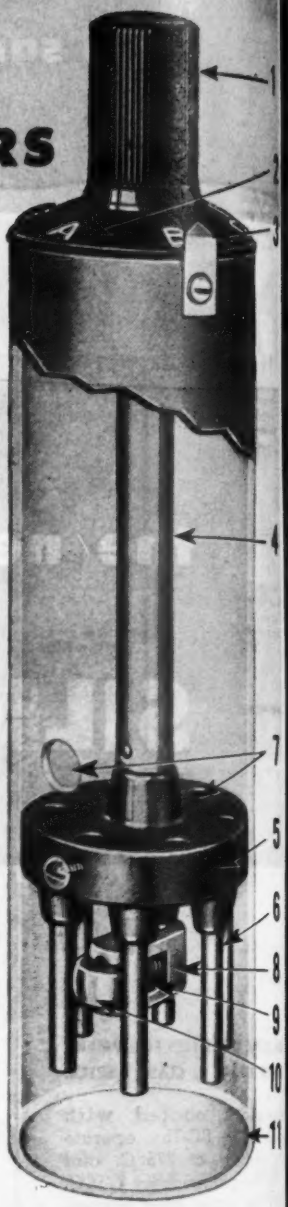

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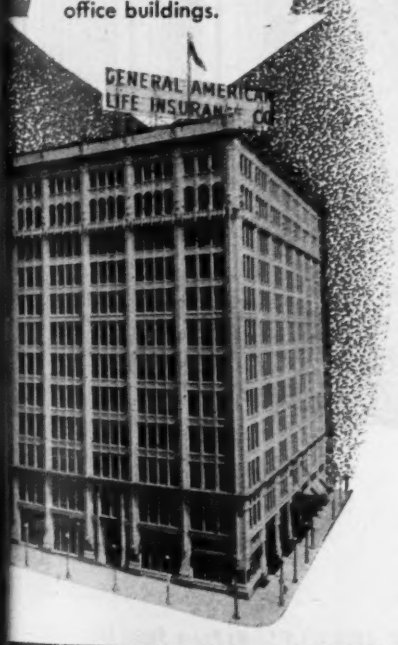

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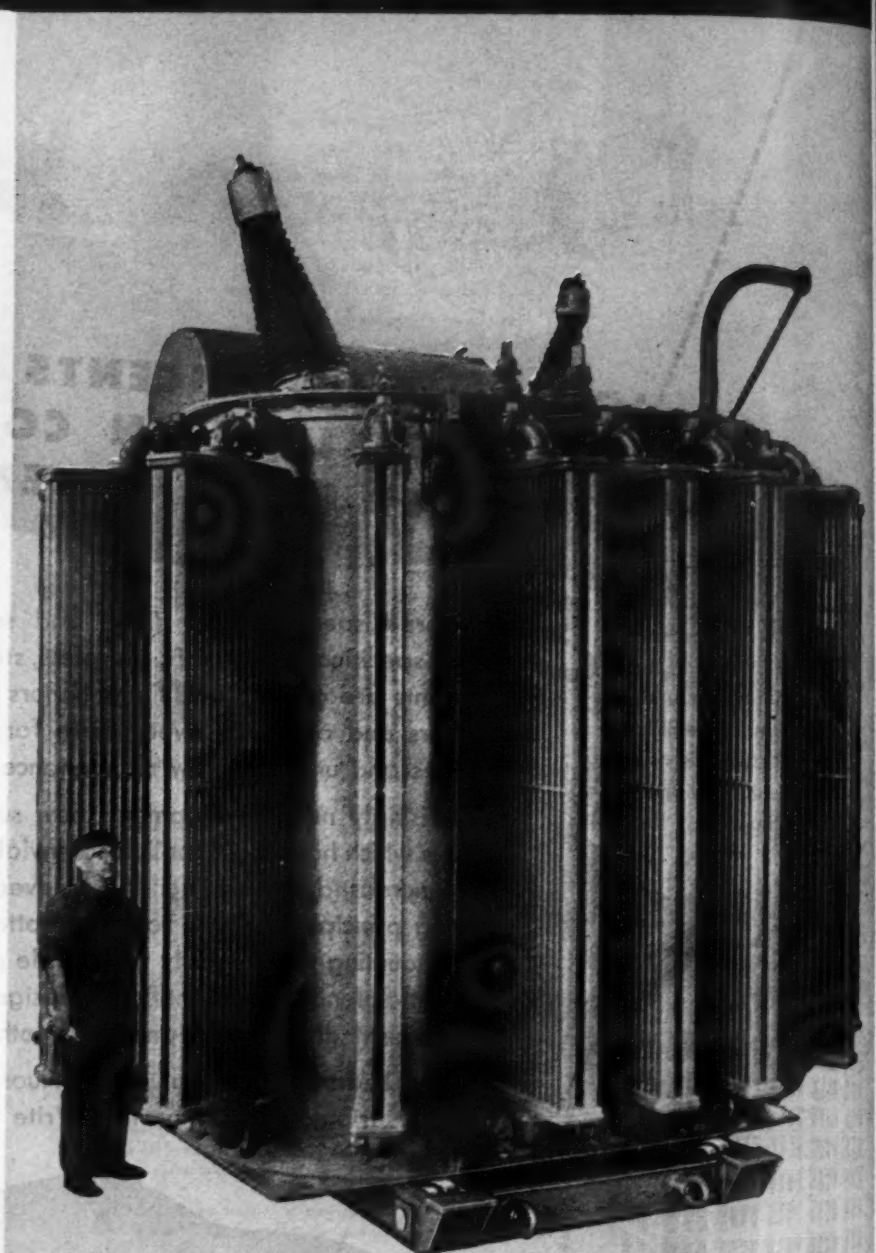

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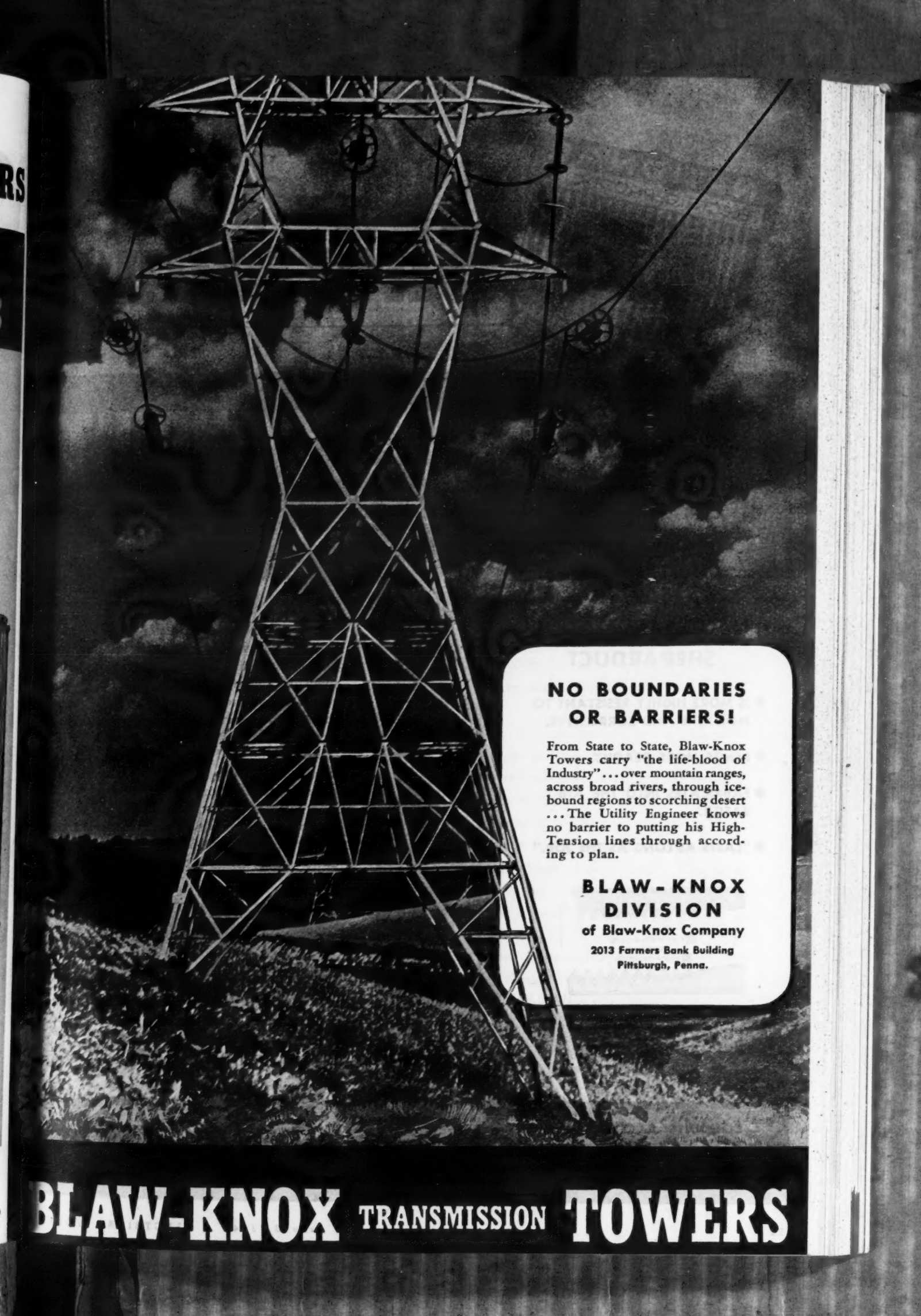
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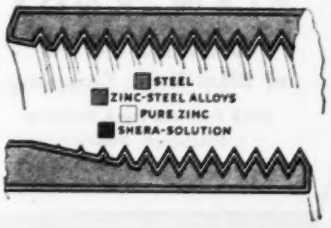

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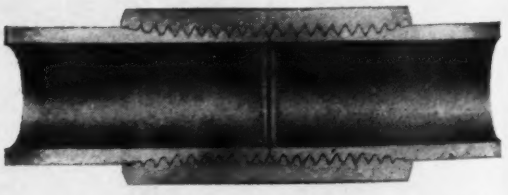

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Electrical World

JUNE 9, 1945

Engineering Education

THIS IS THE MONTH when in normal times our colleges would be graduating a new crop of engineers. This year as for several years there is no crop. Instead the universities have been engaged in preparing our fighting men for the technical problems of war.

As the educational institutions turn back to training men for professions it is akin in some ways to starting anew. It is a good time, therefore, to challenge the pre-war methods in the light of employer requirements. Since engineering schools are set up to train men who want to work in industry the colleges want to know what kind of preparation industry desires.

In England the answer was made two years ago by each of the three basic engineering societies working independently. In this country the answers have come from individual employers or expressions of opinions in meetings.

While there has been no formal statement of this nature from our national engineering bodies to guide the teaching profession the expressions of individual opinion indicate fairly general agreement on principles. It is only on method that opinions differ materially.

The first principle that appears to have universal acceptance among employers, and the English are of like opinion, is that engineering curricula place most emphasis on fundamentals and less on specialization. In the electrical industry where one hardly knows much of the time whether one is working on a mechanical or electrical engineering problem the wisdom of such advice is obvious.

Back of this, of course, is the thought that since one cannot learn everything in college he should be so well grounded in fundamentals that he can work out new problems as they arise. In other words, emphasis on fundamentals teaches a student how to think, how to approach a problem which essentially is the essence of engineering.

Next in agreement among employers is the need for a sound education in the use of English, both written and spoken. There is much we could say on this subject after years of reading manuscripts and hours of listening to technical paper presentations and discussions. It is encouraging to find that employers are also becoming aware of this deficiency in the average engineer.

And finally there seems to be considerable agreement on the advisability of broadening the engineering curriculum to include more cultural subjects. This would indicate that employers find engineers as a whole too narrow in their interests with the result that they lack imagination in their approach to their work. The great problem with engineering is that through its laws and practices it makes men early slaves to experience.

The needs of the world of tomorrow call for great imaginations. They call for greater dissatisfaction with the past than ever before. In war our engineers rose to great heights in accomplishing the impossible but they had the problems given to them by others. In peace they will have to supply the problems as well. Therefore, we add to industry's requirements of education one more, the most difficult perhaps of the lot and yet the one offering the greatest potentiality, inspiration.

Dry-Type Power Transformers Are Finding Their Place

Survey of industrial and utility users indicates satisfaction with maintenance and indoor performance—Supplementary precautions moderate—Industrials prone to overload, utilities not—Interest manifested in outdoor adaptation—Suggestions for improvement

A. E. KNOWLTON, Associate Editor, "Electrical World"

SELECTION of dry-type transformers for both industrial and utility application appears to be dominated by desire to avoid fire hazards. Protective features applied are essentially those applied to liquid-filled types; ventilation and air circulation likewise. No adverse experience with overheating due to dirt accumulation is reported; in general, dirty atmosphere locations are avoided.

These and ensuing generalizations arise from a survey which, however, reflects considerable spread of practice and opinion. Cleaning periods run from every three months to not-at-all in four years. Insulation testing, if done, is done at an average six month period. Industrials are prone to overload the units somewhat, the utilities not. Conclusion from the survey is that dry-type transformers indoors are suitable and preferable for some two out of three indoor industrial applications but, for a substantially smaller fraction of utility cases.

Represented in the survey reports are 27 industrial plants and 12 utility companies. Of the industrials, six are coal or other mining, five are chemical or food, three are aircraft, and two are government bases. Ratings of the units range from the lower limit of 150 kva. set in the survey to as high as 2,000 kva. The average size in industrial plants is 750 kva.; one plant has no less than 45 units of that particular rating. Maximum rating among utilities is 1,500 kva. and that size predominates, bringing the average size somewhat higher than for the industrial applications.

Specifically reported by the industrials are 79,352 kva. but enough others say "sizes from 100 to 1,000 kva.," or "eight from 50 to 2,000 kva.," or "up to 1,000 kva." to warrant the statement that well over 100,000 kva. are represented in all because the utilities enumerate 9,883 kva.

Factors Influencing Use

Control of hazard is the dominant reason for adopting dry-type transformers by both industrials (18 of 27) and utilities (10 of 11). Space requirement comes second in order for the industrials (14) and required maintenance is a third factor (12) with cost of the installation coming next (11 entries). In the case of the utilities insurance rates and cost of installation take second and third place (4 mentions).

Several other factors were mentioned by industrial engineers as influencing their decision in favor of dry-type units; weight (as affecting floor loading), availability of ideal atmospheric conditions, reduction in fire hazard, elimination of floor drains, wartime availability of such equipment and its requirement of less critical materials. Mere curiosity was cited by one industrial user. An added point mentioned by a utility was that this type of unit can be nicely coordinated into design.

Locations Chosen

Q. What locations (plant, office, mine, manholes, etc.) were chosen for application of dry-type transformers in preference to liquid filled?

Among the general manufacturing plants most of the locations are in the factory or mill areas but it is mentioned in some cases that they are placed in the basement or on roof trusses; some serve the office building, the research laboratory or the establishment's own power plant. Four of six mining enterprises use the dry-type transformers directly in the mines, others in the control room or to serve building power or in conjunction with a portable rectifier substation. Two aircraft plants placed them either on roof trusses in the form of radial substations or in basement vaults to serve a network distribution system. Government bases placed them in vaults or indoor substations to serve shops.

Eight of eleven utilities use them in power houses for auxiliary supply; two to supply their office buildings. One installation of a submersible type in a street manhole was mentioned and another utility reports experimenting with a dry-type in an hermetically sealed case for underground network service. One early type has been used for as long as 25 years in conjunction with a rotary converter.

Supplementary Specifications

Q. In purchasing dry-type transformers, what requirements and accessories beyond the manufacturer's standards are specified?

A majority of both industrials and utilities specified nothing not regularly supplied by the manufacturer. There were cases where temperature indicating devices were stipulated and

FIG. 1—Typical 600-kva. substation in manufacturing plant. Oil fuse cutouts are covered for mechanical protection

others where voltage taps or external tap-changers were specified (even though not obtainable). Primary and secondary connections were wanted in one instance. In two instances a 25 deg. C. rise instead of 80 deg. C. was specified.

One utility asked for three-pole, two-position grounding switch on the 13-kv. side of three-phase units; two of three units forming a bank are equipped with two-pole, two-position grounding switches.

Protective Features

Q. When installing, what (if any) protective features were applied?

No protective features not normally applied to liquid-filled transformers appear in general to be applied to the dry-type units. Replies indicate the variety of measures taken: (1) oil circuit breaker on the primary side, branch breakers on the secondary; (2) breaker with time delay and overload protection; (3) breakers in primary and secondary, reactors in primary; (4) 5-kv. drop-out fuses; (5) expulsion-type high-tension disconnects, low-tension air circuit breakers; (6) primary breaker or network protector; (7) primary disconnecting type fuses for each transformer, backed up by oil circuit breaker for every six units; (8) load break switch and current limiting fuses; (9) in conjunction with metal-clad switchgear; (10) BA fuses on radials, network protectors on loop; (11) gang-operated oil fuse cutouts. Temperature alarms were reported by only two industrials, one a mining enterprise.

One utility applied a high temperature alarm with remote indication and another wants an alarm only if an hermetically sealed unit becomes available. Enclosure to isolate and railings to prevent mechanical damage were also mentioned, by both utilities and industrials. Carbon dioxide supply was conveniently at hand in one utility installation so it was connected into the combined bus and transformer room where the dry-type transformer was installed.

Ventilation and Circulation

Q. Were any special provisions made to ventilate the locations where dry-type transformers are installed?

Approximately half the industrial responses indicate that no special provisions are made, at least nothing that would not have been done if the transformers had been of the liquid-filled type. Some are merely placed in already well-ventilated rooms or located in air courses, where plenty of clean, cool air is normally provided. In some cases ventilating louvers were added but these would presumably have been added for any other transformers.

One general manufacturing plant resorted to forced circulation in small rooms and directed natural convection in the larger rooms. Another resorted to special ventilation only for the larger units whose losses would produce appreciable heat. In one aircraft plant the transformers subjected to overload were equipped with fans to increase output to 125 percent; a second had a widespread air-conditioning system and resorted to special ventilation only for the transformers located beyond the reach of the air-conditioning system.

Three utilities did nothing special, four used ventilating fans to maintain a satisfactory ambient. In another instance the already existing exhaust fans in the bus room took care of the requirements. Provision of at least two square feet of ventilating opening per 100 kva. is made by one utility in each vault whether the units are liquid-filled or dry-type.

Q. What special provisions (if any) were made to assure circulation of clean cooling air?

Again, half or more of the industrials and utilities did nothing special. Filtering was mentioned by only two industrials (no utilities found it necessary). One general manufacturing plant uses Fourdrinier wire screens on the air inlets. In a plant using electric melting furnaces the associated dry-type transformers have been in service for over three years; because outdoor air is used for cooling, there is, however, an objectionable variation in ambient. Filtering has "reduced maintenance practically to zero and we would not hesitate to expand our facilities by using the same type of equipment."

Q. Has overheating or other unsatisfactory operation because of an excessive accumulation of dirt on the windings been experienced?

Not one of the industrial plants reported overheating because of dirt accumulation. Manifestly, however, the answer rests on the inherent cleanness of the air, the periodic inspection and cleaning which averts possible trouble or the reliance on an occasional filter. Some of the units are too new to afford an answer. A few have not yet had the transformers fully loaded.

Utilities unanimously report no adverse experience. One reminds that its units are hermetically sealed against entrance of either dirt or water. Another adds that "careful inspections have not indicated a need for abnormally frequent cleaning".

Cleaning Practice

Q. How often, and by what methods, is dirt which has settled on the windings removed?

Quite a few (seven in fact) have not found any cleaning necessary at all even after up to four years of service

FIG. 2—Unit installed in mine in conjunction with enclosed buses

of a unit as large as 1,000 kva. In general, however, cleaning is resorted to; the much preferred method among industrials is by use of blown air. Six industrials report use of both vacuum cleaner and blown air.

General manufacturing plants using blown air use the following expressions; "low-pressure air (cooled and dried)," "annually with 60 psi. air-set," "quarterly in foundry, semi-annually elsewhere, use 42 psi. air," "dry air-blast annually," "hand-blower," "three months air jet and dustingbrush", "seldom (due to filtered cooling air), use hand-cyclone blower." Those using vacuum say, "vacuum cleaner and hand operated bellows every six months," "have set up six-month cleaning period for all equipment in substation, use clean rags and vacuum cleaner."

Mines and refineries report only use of blown air; "compressed air every six months," "location clean, once a year with blower fan," "blow with dry compressed air when inspection indicates." One says "two years after installation no cleaning has been necessary;" another reports 15 months, and a third 18 months.

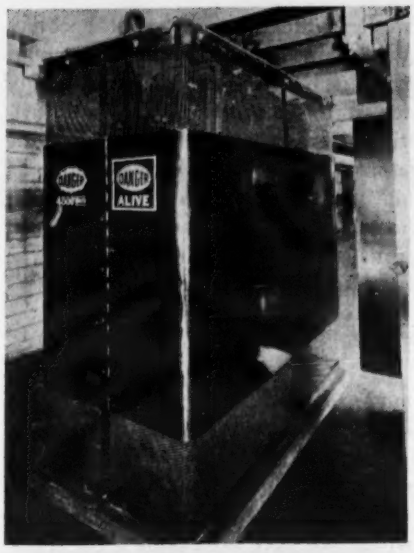
Air Cleaning

Among the chemical and food group use of blown air is almost exclusive; "yearly, using a hand blower," "every two weeks, using a low-pressure portable blower originally bought for motor maintenance," "filtered, compressed air yearly, along with vacuum hose." One says, "no cleaning program in effect, manufacturers should specify means and method."

Aircraft plants reporting use both blown and sucked air; "vacuum cleaned and blown out with dry air about every six months," "about once a year with brushes, vacuum cleaner and air hose."

Government bases use blowers; "as a test, some units have not been blown out since installation four years ago, others blown out once a year with air hose after first removing sides," "dry clean air is best, do not wipe off around insulation."

Utilities report as follows: "the dust on windings of the two units in service has been blown off once with compressed air and hose (covers removed) after two years of service," "blow down about every three months," "40 psi. once a year," "air hose every six months," "time interval varies, advantage taken of major equipment outages to blow dust off core with compressed air." Two others use vacuum cleaners; "vacuum cleaner and compressed air, no stated intervals." One utility states; "it has not been necessary to clean periodically; windings of one 3-phase transformer were cleaned once in six years using small portable vacuum cleaner."



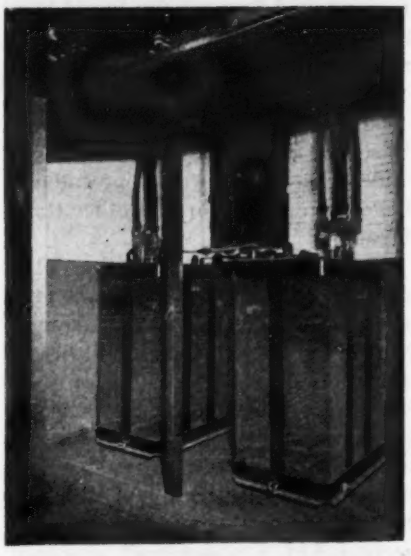


FIG. 3—Representative applications by two utility companies

Atmospheric Conditions

Q. Are the dry-type transformers operating in particularly dirty or deleterious atmosphere?

Generally, the answer is "no" but there are a few significant exceptions. One general manufacturing plant mentions "only oil vapors and metallic dust," another says the dry-type transformer is in the "foundry next to cinder pit." Mines report "some fine dust, no moisture," "yes, in heading of coal mines where they rock dust frequently," "underground, damp, in atmosphere where rotating 2,300-volt equipment must be operated at least twice a week to keep dry." One chemical plant states "small concentration of SO_2 atmosphere for three years, no ill effect." An aircraft plant says, "yes, in roof trusses over saltpot, Hammer house and Kerksite pots." Dry-type transformers are installed in the woodworking shop at a government base.

Eight of the utilities said merely "no." However, one added "but there is some flyash accumulation." Another mentioned coal dust and a sulphurous atmosphere.

Insulation Tests

Q. Are inspections or tests made to determine the condition of insulation in the transformers; what tests, how often?

Use of an insulation tester at from quarterly to yearly periods seems to be the average procedure in checking the condition of insulation in dry-type transformers. Among several industrials the measurement period mentioned most frequently is six months; there are, however, some who say "inspection only," "no visual inspection when cleaning," "none made to date" and others "resistance test at high voltage d.c.," "insulation resistance tests of windings and feeder cables." One says, "watch for corona" as an indication.

Four of six mines and refineries say "no tests made," one says "yes, yearly" and the sixth "insulation test to ground with megohmmeter." One of six chemical plants says, significantly "no tests as yet but our oldest installation is only eight years old." annual tests seem to be the rule with four others, one saying, "insulation test annually for insurance company," another "tests yearly, inspections monthly." A sixth chemical plant says, "Doble tests once a year." Two of three aircraft plants make no insulation tests; the third reports using megohmmeter when necessary to service the transformer."

Insulation testing is the practice of the majority of utilities reporting and the period, here as well as with industrials, ranges from three to twelve months with some saying "at convenient times" or "at time of cleaning

viable)." From the minority which does not measure insulation resistance came these comments; "annual inspection of vault type, no test" and "visual inspection for dirt on the windings (no tests mentioned)."

Overloading Practice

Q. Have the dry-type transformers been subjected to overloads? If so, to what percent of rated load, for how long and how often?

Dry-type transformers generally speaking have not been overloaded either in utility or industrial service. There were reports, however, up to momentary loading to 200 percent of rating and other instances of 25 and 50 percent fairly continuous overloading were cited. One of the reports said "125 percent load for four hours in every 24," another "trial test of 200 percent load for one minute" and still another "a 450-kva. bank was overloaded to 120 percent continuously for six months, eight hours daily, six days a week." More moderate loading of 110 percent for eight hours daily was reported by another industrial.

The utilities, to a greater percentage than the industrials, reported no overloading of dry types. As one put it, "no, type of service and choice of capacity prevents overloading" and that may characterize a cautiousness on the part of the group.

Outdoor Suitability

Q. Does the present unsuitability, in general, of dry-type transformers for outdoor operation restrict the use contemplated for them?

Industrial plants generally say "no" and some add, by way of explanation, that they are not needed outdoors or offer no inherent advantage. One, a mining concern, says "we will use dry-type transformers on indoor installations; however, if we felt they were absolutely dependable under conditions of 98 percent humidity, we would use them underground." Another, "yes, their unsuitability to submersion restricts their use even indoors; when outdoor dry-type is available they will be used here." Still another, "generally we prefer oil outdoors, however, dry-type would have advantages for roof locations" if rendered suitable.

Utilities express more desire for outdoor installation as typified by "yes, they should be in hermetically sealed cases" or "totally enclosed unit looks promising for use in submersible locations." Another suggests "see no reason why, with adequate enclosure, they could not be so used." Against these there is the comment "there are locations where dry-type transformers (outdoors) would be desirable, but no urgent necessity appears to warrant accelerated development."

General Suitability

Q. Based on operating experience with dry-type transformers for what percent of all indoor transformer applications are dry-type transformers considered (a) suitable, (b) preferable?

Most of the industrial plants say they are suitable for all their applications indoors—in fact 13 out of 19 who answered the question say so. Two of the others say 50 percent, one 75 percent, two say 80 percent and one says 90 percent. Not quite such a large fraction (seven out of twelve) say preferable in all instances; four of the five others mention preference for 50, 75, 80 and 90 percent of the cases. The fifth, a chemical plant, says "zero" presumably meaning "not preferable."

Utilities indicate, as might be expected, smaller degrees of suitability —10 percent, 25 percent, 50 percent and but a single 100 percent. One says "would consider only for use up to 5 kv. until better insulation is available." Another, "trying to eliminate oil in all indoor electrical equipment." As to preferability there were three utilities that rate them as preferable for 100 percent of the indoor jobs, one other says 25 percent and another 50 percent.

Maintenance Cost

Q. Does experience indicate that the cost of maintaining dry-type as compared with liquid-filled transformers is higher or lower?

A strong majority (18) of the industrials flatly say "lower" and only two say "higher," one of them attributing it to the cleaning operation. Three feel it is neither higher nor lower, using such expressions as "time for oil tests offsets longer cleaning time required for dry-type" or "about the same" or "probably a stand-off." Also, some who said or implied "lower" indicated they had sufficient experience to be sure about it but said "it should be lower." One attributed the lower maintenance cost to "elimination of filtering and less confusion between oil and non-inflammable liquids."

Utilities without exception asserted a lower maintenance cost, one qualifying by saying "possibly a little less." Another utility decried the importance of this factor saying "cost of maintenance is low in either case and any difference could not be an influencing item."

Further Improvement

Q. What suggestions for changes in design are offered toward making present forms more acceptable?

Satisfaction is apparently indicated on the part of nine industrials who said "none." Ten others offered comments, several of which treated the enclosures, two asking easier removal of covers and easier access to windings for cleaning operations. One asks "adequate clean-out doors or panels," another suggests "better screened ventilation or some means of cleaning air." A government base engineer proposes "adequate provision for dust removal without removing sides, plates, etc.; protection against partial submersion due to flooding of location." The same engineer asks added electrical features such as "external tap changer, temperature indicators". Others join on the electrical items by suggesting such factors as "better terminals and more space on high voltage side for greater creepage distance" or "include short circuit protection on primary as standard equipment (fused disconnects of load-breaking type built in)." One industrial wants "weatherproofing" and another wants the units made smaller.

Wider range of proposals comes from the utilities. All these comments appear as follows: "Operate them in sealed cases." "Should be completely enclosed for submersible use and even for indoor use; noise level should be lowered." "Complete elimination of fans and of materials which will burn or suffer reduced insulation resistance due to corona." "Hesitate to recommend extensive use until impulse strength of winding is improved." "Terminal boards and windings should be more readily accessible before and after installation." "More weather proof and less dust-catching." "Better appearance."

Transmission Line Conductor Reinforcement—I

Helically preformed wire armor for points of high concentration of mechanical stress—Conductor fatigue life (in conjunction with companion tie) greatly extended by the protection of the added layer

T. F. PETERSON and J. C. LITTLE†, American Steel & Wire Co., Cleveland, Ohio*

ALTHOUGH line insulation research and development has progressed at a fairly steady pace over the years, conductor support has been the subject of but sporadic attention and study. Following the very fine work of men such as Varney, Templin, and others who made very valuable contributions to our overall knowledge of conductor vibration characteristics, little seems to have been done. The infrequent attention to "conductor support problems" may be attributed in part to a lack of compilations of statistical data on line performance which, had they been available, would certainly have long since pointed to the importance of this part of a transmission line. While the following statements must of necessity be predicated on qualitative analysis of observations coming within the scope of our general experience and more or less unconscious integration of the significance of various causes of line failure, we do not want to minimize the importance of quantitative data on line operation, and we strongly urge at this time that efforts be exerted to accumulate the operational data.

FIG. 1—Set of components comprising preformed armor for conductor

Overhead conductors, whether for use in telegraph, telephone, or power transmission, have been installed for the most part on spool, pin, or suspension type insulators, and many designs of support and "tieing or clamping" have been used. No attempt is here made to describe any of these in detail. However, we would call attention to the gradual introduction of such devices as the following:

(*a.*) Conductor wrapping with strip metal,

(*b.*) Use of shims and seating material in suspension clamps,

(*c.*) Wire wrappings over conductors to produce so-called "armor ties",

(*d.*) Trunnion type suspension clamps and post insulator type clamps,

(*e.*) Armor rods, both tapered and uniform diameter,

(*f.*) Dampers such as the "Stockbridge" resiliently suspended weight and torsional type rigidly mounted to the conductor.

Conductor Suspension Points

Ultimate life of overhead conductor installations is influenced by many factors, and indeed, failures may be ascribed to numerous causes. Some of the devices listed above meet one or more of the service requirements in something like the manner and frequency with which these conditions occur.

On the other hand, much current thinking and engineering seem to be predicated on rather lopsided ideas as to the relative importance of one or another element contributing to failure. For example, from the emphasis in current advertising and engineering discussion placed on "corrosion", one would conclude that this contributes in an important way to determining ultimate life of line. Unfortunately, without statistical data, it is difficult to correct such views. However, accumulating evidence on line performance shows frequent failures due to such causes as:

(*a.*) Wear-tie wire "burning" and chafing of conductor and/or tie wire,

(*b.*) Vibration fatigue of conductor or ties,

(*c.*) Arcing from conductor to ground,

(*d.*) Pitting of conductor inside clamps due to arcs striking clamps and passing to conductor,

(*e.*) Conductor burns at points of lightning strikes,

(*f.*) Tensile breaks during storm loading at points of conductor weakness due to any of the above.

The ideal method of suspension would not only reduce or eliminate these sources of trouble, but would meet other operating requirements with maximum assurance of easy reproducibility of results under all types of installation conditions. Quite

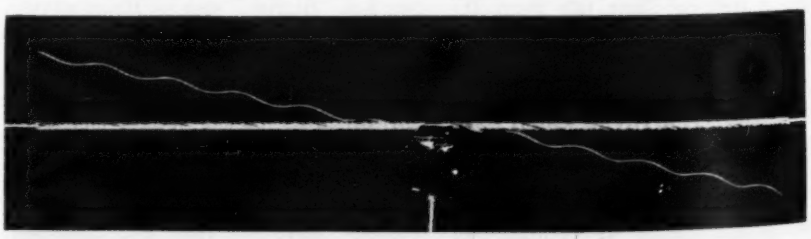


FIG. 2—Armored section of conductor with one preformed element partially removed

* Manager, Electric Sales Division.
† Technical Engineer, in charge of Vibration Fatigue Laboratory.

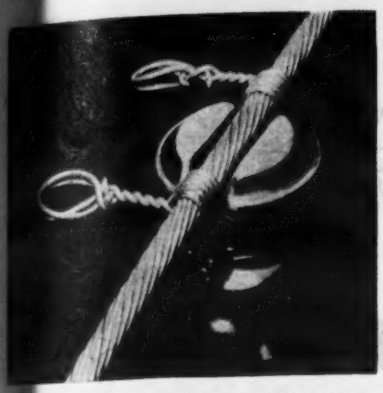


FIG. 3—"Hot-line" tie designed for use over preformed armor

obviously it must be justified economically and must lend itself to installation by linemen of varying skills.

Preformed Armor Rods

Preformed armor rods and the recommended multiple wire ties described in a subsequent installment meet the stated requirements. As shown in Fig. 1, round or shaped wires or strips are preformed into "open" helices having uniform pitch length approximately 12 to 14 times the diameter of the conductor and having an inside diameter slightly less than the outside diameter of the conductor to insure a snug fit. An individual preformed armor rod is held against the conductor and then with a simple rotation of the ends, is applied to cover a portion of the conductor. The operation is clearly indicated in Fig. 2. It will be seen that by proper choice of the number of rods, pitch angle, and the like a complete covering may be developed over the conductor. The rods may be staggered along the length of the line to provide "graded" flexibility at the suspension clamps, dead-ends, or insulator ties. No clips are used to hold the rods on the conductor. Galvanized spring steel, aluminum alloy, hard drawn copper, and bronze have been used in the production of these reinforcements. Although the most general application is at insulators and dead-end clamps, the reinforcements may be applied at mid-sections for effecting line repairs.

Almost any conventional methods of clamping or tieing may be combined with this system of conductor reinforcement. However, extended testing of some special "multiple wire" ties indicates that these are extremely effective and relatively inexpensive and easy to install. Techniques have been worked out which allow application and removal of these ties with "hot line" equipment.

Advantages

ARCOVER of insulators from conductor to ground frequently contributes to line failure, since wires may be burned off or annealed. The preformed armor rods completely covering the conductor preclude this, and since they are under no tensile load, cannot contribute to line failure even when severely burned.

PITTING of conductor strands presumably due to power currents attending flashover to suspension clamps, thence to line conductor, is avoided since extended and intimate contact is made betwen the conductor and armor rods, and in turn the armor rods make very good contact with suspension clamps.

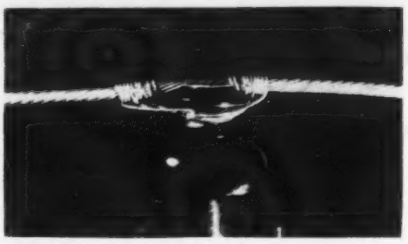


FIG. 4—High resistance to unbalanced tension achieved by use of preformed armor and 3-piece tie

CORROSION of conductors at supports is practically avoided by virtue of the complete covering and minimizing of the action of weathering, electrolysis, and the like at the very points where ordinarily lines are quite vulnerable.

ABRASION AND CHAFING at supports, coupled with accompanying corrosion, are precluded. There is practically no relative motion between conductor and the ends of the reinforcements, and no more relative motion over the entire length than would occur between two layers of concentric strand. The line conductor is, therefore, protected in much the same way as the inner layer of a 19 or 37 wire strand, and the more vulnerable conductor elements are kept out of contact with clamps or ties. Such abrasion and chafing as may occur on the armor rods is of negligible importance in view of their mass, physical proportions, and durability.

HOLDING POWER, or gripping force of the reinforcements is unbelievably high as is evidenced by tests such as shown in Fig. 4, where loads exceeding the strength of the insulator pin were exceeded. The reinforcements grip the conductor so tightly as to bridge broken wires as shown in Fig. 5, and under certain conditions of failure, maintain a high percentage of conductor strength. Ties and clamps have greater gripping area over reinforcements than would normally be provided over the uncovered conductor.

INSTALLATION may be made by the inexperienced, either by hand or with the aid of tools specially developed for the purpose. Precision fabrication facilitates their application in the field without dependence on training or skill of linemen. Rather simple techniques have been developed to allow "live line" application of the reinforcements with a degree of ease which has been hitherto unobtainable where armor was employed.

TAPS AND HOTLINE CLAMPS may be applied directly to the reinforced conductors with minimum danger of reducing the vibration life of line and without danger of conductor corrosion at clamp contacts weakening the line. The large diameter over reinforcements makes for large contact area at taps, hence low contact resistance.

VIBRATION AND DAMPING characteristics are superior to those of many conventional supporting ties and clamps.

Although we do not have sufficient field data to enable us to correlate results of laboratory tests, we submit that the data contained in Part 2 of this paper are indicative of the unusual performance that can be expected in service.

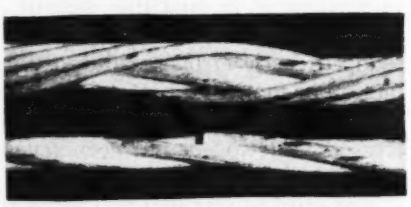
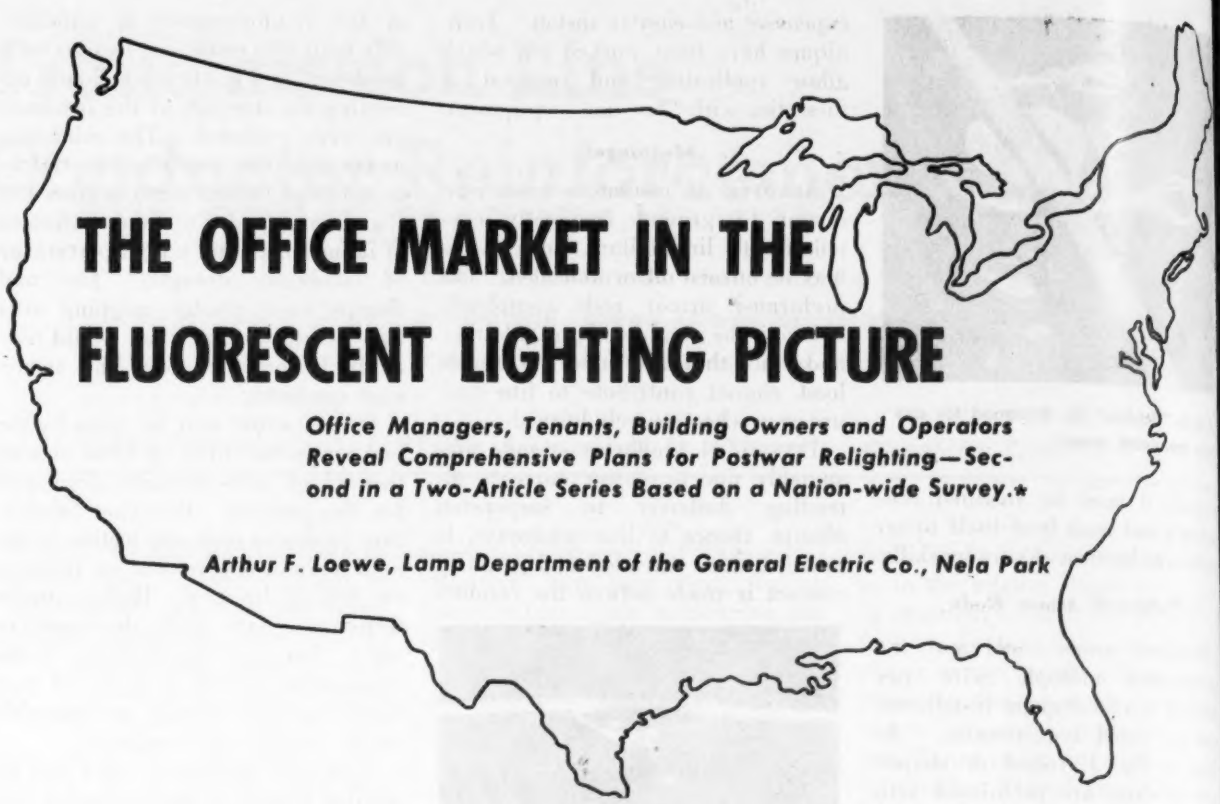


FIG. 5—Fatigue failures of one wire of a 3-wire conductor

(Upper) Still under line tension with several armor components removed to illustrate axial load capacity of the reinforcements. (Lower) Same specimen at same tension with all reinforcements removed, showing conductor separation at failure, at about center of illustration



THE OFFICE MARKET IN THE FLUORESCENT LIGHTING PICTURE

Office Managers, Tenants, Building Owners and Operators Reveal Comprehensive Plans for Postwar Relighting—Second in a Two-Article Series Based on a Nation-wide Survey.*

Arthur F. Loewe, Lamp Department of the General Electric Co., Nela Park

Impelled by the demands of production for war, office and plant managers have evolved many new ways to improve old manufacturing processes that will find permanent place in peacetime practice.

The need for constantly accelerated manufacture of arms and armament has resulted in a more complete partnership between office and plant. Production men have discovered that a lag in paper work, or an increase in errors, cuts machine output and slows down assembly lines.

To those charged with the responsibility of increasing worker efficiency in both office and plant, it has become increasingly apparent that modern lighting installations help to finish more accurate paper work faster. As time study records revealed that better lighting in plants brought measurable improvement in machine output, so office records also proved that ample light for all office procedures reduced costly errors, made possible the faster completion of more and better paper work. In office after office modern lighting has reduced errors, and increased both speed and accuracy in all clerical and machine operations.

Not only in war plants, but in thousands of business and commercial buildings, office managers and building owners are planning to extend to white collar workers the same benefits of modern lighting that have facilitated industrial production. As soon as supplies are again available, the lighting lessons taught by industry at war will find wide commercial application.

Extensive surveys have been made of the results of the first fluorescent lighting in stores, and through the columns of ELECTRICAL WORLD, information has been made available to those who will sell and service post-war fluorescent installations. Not so much is known, however, of the first results of relighting in offices and office buildings, an important segment of the large commercial lighting market and one that previously had attracted considerable attention particularly for the utility lighting engineer.

Relighting Picture Detailed

Salesmen, contractors and distributors who are planning now to serve the fluorescent commercial lighting market may find interest and profit in a detailed picture of the office relighting situation and outlook. Following in general the same procedure used in its extensive survey of fluorescent lighting in the small retail store field, the General Electric Co., with the cooperation of public utility lighting specialists, has just completed a survey of the office market. Office managers and building owners have been questioned to furnish the kind of factual data which sales

* First article in this series which appeared in the January 6, 1945 issue, starting on page 59, carried similar information on the store market for fluorescent lighting.

ecutives will find of most value in their post-war lighting promotion.

It is believed that this survey is definitely indicative national trends. While there are variations due to ctional and population differences, these do not fect the value of this study in bringing more light bear on the national picture of fluorescent relighting of office buildings.

Condensed here is a careful sampling of the attiudes and opinions of those who purchased fluorescent lighting for office installation before war restrictions curtailed supply. What they bought, why and rom whom, and scores of other questions have been sked office building owners, office managers and ffice tenants. Answers to some questions that permitted more than one answer, occasionally result in ercentage totals of more than 100.

Cost Not the Deciding Factor

It is significant that a smaller percentage, only 0.9 percent, of office men interviewed considered ost a deciding factor. Of the retailers interviewed in he national store survey, 54.5 percent were influenced by some phase of cost. Before installation was ade, buyers of fluorescent office lighting considered he following advantages important in prompting he change from filament:

Better Light	36.6%
Cost	30.9%
More Light	25.2%
More Modern	17.1%
Less Heat	13.0%
Employee Benefits	4.9%

While cost rated second mention before they ought, office managers considered four other advantages of greater importance, after an opportunity to iscover the advantages of their new lighting: 38.0 ercent mentioned quality as holding first place in heir estimation of fluorescent lighting; 28.2 percent, mployee health and efficiency; 15.5 percent, modrnization; 11.3 percent, cost; 7.0 percent, increased roduction.

Those who installed fluorescent mentioned more han one factor that influenced them in making the hange to modern lighting, but three out of four redited salesmen and printed matter. Among the actors influencing purchases were: salesmen, 49.6 ercent; other installations, 48.7 percent; printed matter, 26.5 percent.

Tenants Initiated 53.3% of Changes

"Who's the man to see?" is a question that salesmen ask before they start on a call. When office men changed from filament to fluorescent, 53.3 percent of the changes were initiated by renters, 45.9 percent by building owners and operators. The final decision was made 50.9 percent by renters, 48.4 percent by owners and operators. The new installations were paid for 46.7 percent by tenants, 52.3 percent by building owners. In the larger cities, the major number of the installations were paid for in a lump sum; 96.7 percent of all jobs surveyed were paid in this way, only 3.3 percent paid for through an increase in rent.

An indication as to the size of contracts for office installations in the post-war period is found in the question of tenant status.

One of Many Renters	44.7%
Owns Building	41.5%
Rents Building	13.0%

Tenants interviewed were distributed in the following types of buildings: office, 65.6 percent; commercial, 23.8 percent; industrial, 10.7 percent. Office buildings averaged 122 sq. ft. per worker; industrial, 109; commercial, 126, with an average of 2,704 sq. ft. per office. The number of employees averaged 22.5 per office. These were located 81.2 percent downtown, 18.8 percent suburban. Did inadequate wiring prevent installation of as much light as was wanted? Only 9.5 percent of the answers were "yes," 89.7 percent "no."

50-54 Foot-Candles Upper Limit

Wide divergence of opinion was expressed in answer to the question of what the office manager considered his upper limit in foot-candles, with the largest group of 25.7 percent agreeing on 50-54 foot-candles. Only 5.7 percent wanted more; 2.9 percent wanted 15-19 foot-candles; 8.6 percent, 20-24; 8.6 percent, 25-29; 11.4 percent, 30-34; 14.3 percent, 35-39; 11.4 percent, 40-44; 1.4 percent, 45-49; with 10 percent undecided.

More than half, 53.9 percent, selected suspended type luminaires, 37.1 percent ceiling, and 9.0 percent continuous line installations.

Occupants Pleased with Installations

Although undecided before buying as to how much light they needed, office men generally liked their installations; 90.2 percent were pleased; 4.9 percent were not; 4.9 percent were undecided. Even a larger percentage, 99.2 percent, said they would recommend fluorescent to their friends. Since more sought advice, used a planned layout, a larger percentage of office men received a more adequate lighting installation than was the case with retail store operators studied in the related General Electric survey of small retail stores. Consequently, when asked if they were sorry they did not install more, only 25.0 percent answered "yes," 73.3 percent "no." When lamps and luminaires are again available, 31.3 percent said that they will request or install more, 51.3 percent will not. Only 6.7 percent intend to add supplementary lighting; 37.5 percent will use fluorescent for supplementary lighting; and 12.5 percent will use this on desks or business machines.

88.6 Percent Had Advice Before Buying

Other surveys have revealed many fluorescent installations made without layouts or advice. Of the office men installing fluorescent, 88.6 percent sought advice before buying, from the following sources: utility representative, 61.5 percent; contractors and fixture salesmen each 20.2 percent; jobber salesmen, 11.9 percent; lamp company representative, 7.3 percent.

Planned layouts were made for 73.3 percent of the office installations surveyed. Layouts were made by the following:

Utility Men	62.5%
Fixture Salesman	11.4%
Contractor	6.8%
Jobber Salesman	5.7%

Of those questioned, 86.6 percent know their utility men. Before purchasing more lighting, the office men said they would go to the following sources for advice: 82.9 percent to utility representative; 15.9 percent, contractor; 7.3 percent, lamp company representative; 7.3 percent, jobber salesman; 6.1 percent, fixture salesman.

Who Will Sell?

Contractors sold 45.3 percent of the office jobs surveyed; fixture salesmen, 18.8 percent; jobber salesmen, 17.9 percent; utility salesmen, 15.4 percent, miscellaneous agents, 2.6 percent. The 31.3 percent who are planning to install additional fluorescent lighting say that this business will be divided as follows: to contractor, 50.0 percent; jobber salesman, 23.9 percent; fixture salesman, 13.0 percent; utility, 8.7 percent. Sources from which renewal lamps have been purchased were given as wholesale, 38.0 percent; contractor, 31.4 percent; retailer, 17.4 percent; utility, 8.3 percent; door to door, 2.5 percent.

60.4 Percent of Meter Readings Are Up

As they affect lighting load, a number of factors are involved in the change from filament to fluorescent. Naturally, these will interest utility men who would want to know the relation between kw.-hr., installed kw. and meter readings, before and after, ratio of practical goal to fluorescent intensity installed, number of present and previous luminaires, and how much the lights were used before and after the change.

In the comparison of meter readings, showing all office use of electricity, 60.4 percent showed more; 38.5 percent less; 1.0 percent same. Present kw.-hr. for lighting only to previous were given as, 54.7 percent more, 40.7 percent less, 4.7 percent same. Former kw. to installed revealed 47.0 percent with more, 47.9 percent with less, 5.1 percent same. The majority of office owners, managers and tenants not only asked for advice, but followed it, as proven in the ratio of practical goal to fluorescent intensity when first installed.

Practical Goal/Installed Intensity = 1	49.6%
Practical Goal/Installed Intensity = 2	39.1%
Practical Goal/Installed Intensity = 3	6.1%
Practical Goal/Installed Intensity = 4	2.6%
Practical Goal/Installed Intensity = 5 or more	2.6%

In answer to the question, "Do you use your lighting longer hours?", the following replies were given: 42.0 percent more, 47.1 percent less, 8.4 percent the same.

Those making up the part of the office market interviewed avoided the mistake of replacing fixture for fixture and 66.4 percent, installed more luminaires than they had formerly, 27.9 percent installed the same quantity, 5.7 percent installed less fixtures.

The foregoing figures and opinions are based on interviews with those who had used fluorescent long enough to make a fair comparison with their former filament lamps. A number of these were influenced by the modern lighting of their neighbors. How much will better lighted offices help to sell neighbors in the building or block who plan to modernize, post-war? Five additional questions were put to a sufficiently large group of potential customers in the immediate neighborhood to furnish a fair cross-section of the opinion of nonusers.

67.0 Percent Non-Users Plan to Buy

Office managers and building operators who have seen the modern lighting of their neighbors were asked, "Will you install fluorescent lighting post-war?" Of these, 67.0 percent answered "yes"; 13.2 percent, "no"; and 19.8 percent were undecided. Asked whether they would install more or less light than their neighbors, a trend to higher intensities may be indicated in the replies showing:

Want More Lighting	28.3%
Want the Same	34.8%
Want Less	10.9%
Undecided	26.1%

The extent to which earlier fluorescent installations will influence the post-war market is indicated in the answers to the question, "Would you install the same type of equipment as your neighbors?" Replies indicate a lot of selling to be done, since 34.9 percent answered no, 37.2 percent were undecided, and only 26.7 percent plan to buy the same type of equipment they have seen in use.

Educational Work Needed

Shielded light sources are found in a large percentage of the more modern installations, and some educational work seems to be in order with the potential customer for office lighting, since they indicated

SUMMARY

Significant Figures of the Survey Revealed

That . . . **73.3%** of office managers had planned layouts made and **53.3%** of jobs were initiated by renters

That . . . **47.9%** of office managers decreased their interior lighting load, showing **4.4%** increase in kw.-hr.

And . . . **38.5%** of meter readings of total office use dropped

Yet . . . **60.4%** of office managers used lights longer as shown by the records

While . . . **30.9%** of office managers were prompted to purchase by some cost saving

Yet . . . **83.8%** obtained more light than before

Yet . . . **50.4%** in interviewers' opinion bought inadequate jobs or were undersold

And . . . **36.8%** more kw. could have been sold for interior

While . . . **40.4%** of office managers buying were influenced by neighbors

Only . . . **61.5%** of office managers got advice from utility before purchases

And . . . **82.9%** of office managers who will buy more, will now seek advice from utility

Finally . . . . . of the office managers now using filament lights **37.3%** hope to purchase or request more fluorescent, **10.5%** are undecided, **52.2%** will not

preferred equipment in this order: bare lamp, 23.3 percent; semi-direct, 15 percent; louvered, 11.0 percent; enclosing, 6.8 percent; recessed, 2.7 percent; latest type, 6.8 percent; and with 30.1 percent undecided.

Before deciding on the details of fluorescent installations, it appears that most office men not now using fluorescent will seek advice, some consulting more than one source, as follows: utility, 75.3 percent; fixture salesman, 5.6 percent; contractor, 13.5 percent; jobber salesman, 5.6 percent; lamp company representative, 4.5 percent.

A few pertinent comparisons might be found between this survey and the study of the national small retail store lighting field published in the January 6 issue of ELECTRICAL WORLD. Office men who have already installed fluorescent lighting appear to have been less influenced than store operators by various phases of cost. A total of 73.3 percent used a planned layout, compared with 42.2 percent of the retailers. Also, a larger percentage, 88.6 percent, of the buyers of modern office lighting asked for advice. Contractors sold 45.3 percent of the office jobs, 28.9 percent of the retail installations. Since they invested in a more complete installation, a greater number of office lighting buyers were more completely satisfied and will recommend new lighting to their neighbors. Only 26.8 percent of the retailers and 26.7 percent of the office managers are planning to buy the same kind of equipment as their neighbors who have already installed fluorescent. Consequently, a sizable job lies ahead of those who will supply the post-war demand for lamps and fixtures.

It is a job that calls not only for hard-hitting sales but promotional and educational planning. With the coming of peace, when new fluorescent tools are available for wide commercial use, the application of new lighting techniques, learned from the necessities of war, will facilitate every office task. Modern lighting will help to bring new speed and accuracy to the operation of more types of business machines, help to serve the health and comfort of more office employees.

Pensacola Plant Simple, Adapted to Gulf Conditions—I

Open boiler and turbine rooms—One level operation—Heater drain system flexible—Bayou to bayou condensing supply—Glass blocks for light—Ventilation unique—Plant substructure on capped piling

*E. C. GASTON, F. E. HALE and A. MERGENTHALER,**

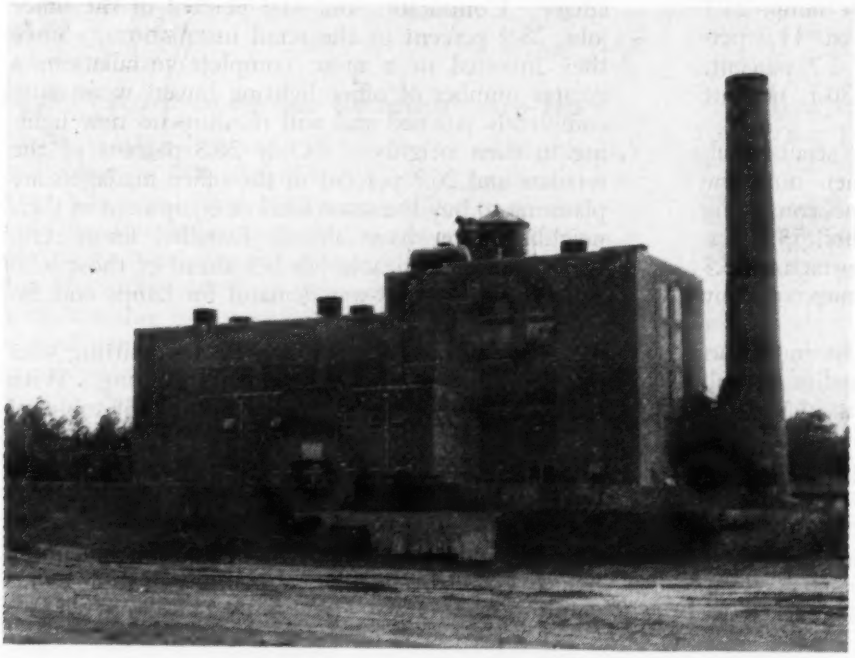
INITIAL 22,500-KW. UNIT of Gulf Power Co.'s new high pressure steam plant at Pensacola, Florida is now in operation. Design and layout contemplate expansion to 90,000 kw. in four units of identical rating. The plant typifies simplification of operation and aims at full-load economy of 12,700 B.t.u. per net kw.-hr. when burning natural gas and with normal condenser vacuum of 28 in. mercury. The unit was placed in operation in less than 15 months after clearing for the site was started.

Plant is located on the Escambia River which affords an adequate supply of cooling water. This river is subject to tidal fluctuations with an average tidal range of 2½ ft. and maximum of about 11 ft.

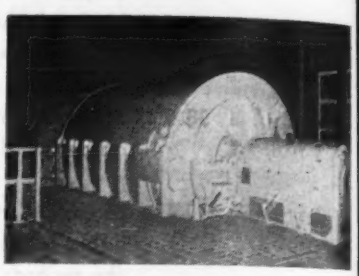
* Engineer in Charge of Design, Civil Engineer and Electrical Engineer respectively, Commonwealth & Southern Corp., Birmingham, Ala.

Substructure and Building

Substructure for the power house is supported on untreated timber piling driven or jetted to an average depth of approximately 35 ft., each pile being designed to support a maximum load of 20 tons. To reduce the possibility of marine borers attacking the piling, protection is obtained by capping, with concrete, the piles next to the river and by driving sheet piling several feet below the low water stage of the river to obstruct direct passage of the borers from the water to the piling under the plant.



GLASS BLOCK CONSTRUCTION eliminated critical sash; substation at left; intake in front; deaerating heater on roof; office annex in foreground

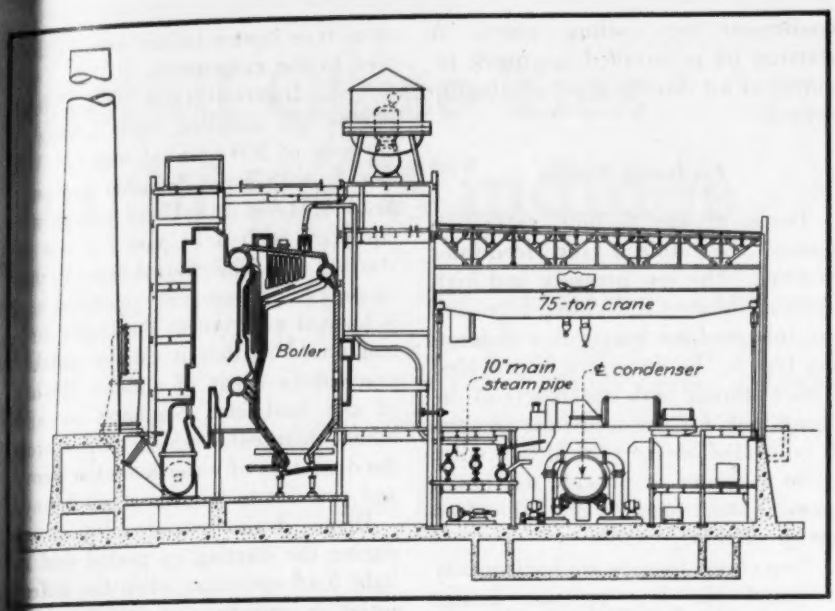


NO WALL BETWEEN 22,500-kw. turbo-generator and boiler rooms

Power house superstructure is of brick and steel construction. The general design is simple and the building contains a minimum of ornamentation. However, there are several features in the design which deserve special mention.

One feature is that of lighting and ventilation. Due to restrictions on the use of steel for sash, the amount of sash has been reduced to an absolute minimum required to obtain necessary ventilation. A band of sash extends around the entire plant building at ground level to provide necessary area for admitting fresh air into the building proper. No sash is located above the operating floor level except on the second floor of the office annex. Ventilating air is discharged from the building through large roof ventilators, each of which is equipped with a motor operated fan to assist in providing the required draft. For additional insurance in obtaining adequate air for ventilation, four areaways have been located in the substructure of the building and these are designed so that fans can be installed in them to provide forced circulation if required in hot weather.

In order to obtain additional na-



ALL EQUIPMENT REQUIRING operating attendance is on or below the main operating floor level. Boiler and turbine room control board located back-to-back

ral light, glass block has been utilized in lieu of sash. The block is installed in paneled sections to provide a pleasing appearance. These paneled sections also accentuate the height of the building. No ornamental stone or other type of building trim has been used except a stone coping around the parapet walls.

Wall Eliminated

There is no wall between the boiler and turbine rooms, which feature of design makes it possible to locate the boiler and turbine room control boards back-to-back on the operating floor level at a point convenient to both the turbine and boiler. The arrangement of principal and auxiliary equipment is compact, and all equipment which requires operating attendance is located on or below the main operating floor level. This feature of the design has eliminated the necessity for the service elevator and also makes it possible to operate the plant with a minimum of personnel.

Arrangement of the circulating water system makes use of natural waterways in such a manner that the intake water is taken from one bayou and discharged into another. The arrangement is such that there is a minimum chance of recirculation of hot water even though water supply is affected by tidal changes, since there is a distance of approximately 3,300 ft. from the discharge structure back to the intake structure.

The boiler has a maximum capacity of 230,000 lb. steam per hour continuously and is a Riley Stoker Corporation standard three-drum unit. It is designed for 975 psi. maximum working pressure, and is equipped with convection type superheater with by-pass damper control to maintain a constant total steam temperature of 860 deg. F. at all boiler ratings from 140,000 lb. steam per hour to 230,000 lb. steam per hour. The furnace is designed for low heat liberation of 21,600 B.t.u. per cu. ft. per hour on the basis of probable future firing with pulverized coal. Initially the unit will be fired with natural gas and/or fuel oil, but the design, not only of the boiler but of the entire plant, is arranged for future installation of coal pulverizing and burning equipment with a minimum of building, structural and layout changes.

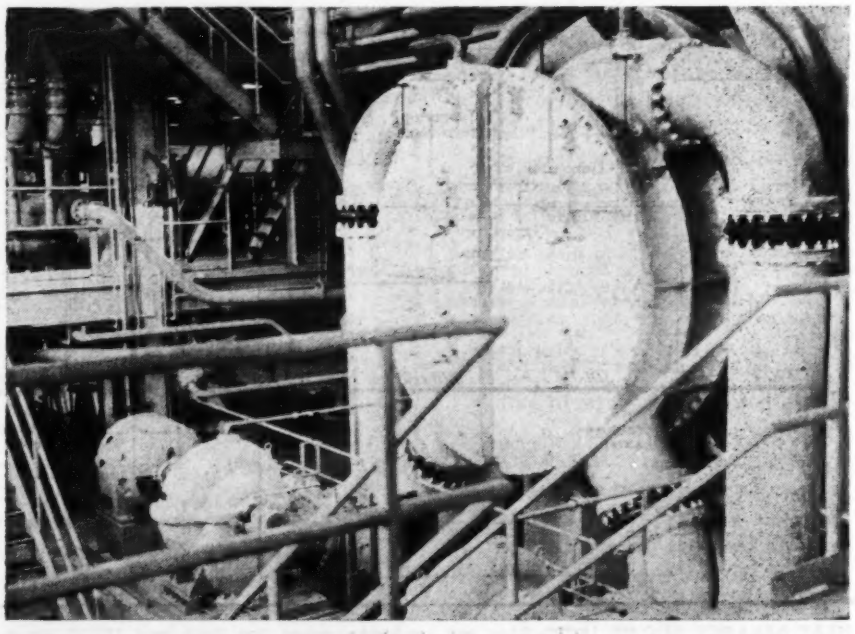
Only heat recovery equipment installed in connection with the boiler is a Riley tubular-type, air heater (31,500 sq. ft.). The heating surfaces in the boiler and related equipment are as follows:

Boiler	11,700 sq. ft.
Superheater	9,550 sq. ft.
Water Cooled Wall	7,885 sq. ft.
Air Heater	31,500 sq. ft.

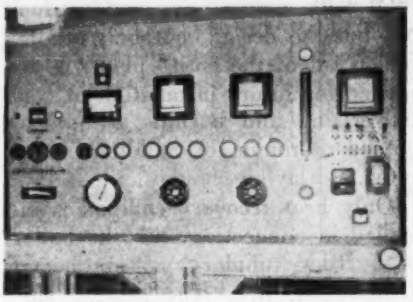
One forced and one induced draft fan are installed, both being American Blower Corporation design. Both fans are equipped with vane or louvre control and are driven by two separate motors, the small motor having capacity to drive the fans up to plant load of 20,000 kw., and the large motors being used for higher plant ratings. The forced draft fan has a capacity of 77,500 cfm. of air at 100 deg. F. against a static pressure of 12 in. of water at 1,180 rpm. The induced draft fan has a capacity of 140,000 cfm. at 425 deg. F. and will develop a total draft of 12 in. of water at 705 rpm.

Turbine and Condenser

Turbo-generator is a General Electric Co. single casing, single-flow condensing unit, designed for 850 psi. 900 deg. F. throttle steam conditions.



CONDENSER AND CIRCULATING WATER PUMPS; inter and after-condensers at left



TURBINE ELECTRICAL CONTROL (left) and hydrogen panel (right) with turbine operating instruments between

The unit is rated 22,500 kw.. 90 percent power factor (or 25,000 kva.) 12,000 volts, 3 phase, 60 cycle. By "spring mounting" the generator armature, the effect of double-frequency vibration is minimized. A motor-operated turning gear is installed for use in starting and stopping the unit.

The turbine exhausts to a 20,350-sq. ft., two-pass, divided water box, C. H. Wheeler Manufacturing Co. condenser. The condenser tube sheets are Muntz metal and the tubes are Aluminum Brass to resist the corrosive action of brackish water. The condenser is equipped with two circulating water pumps and two condensate pumps, one of the condensate pumps being a spare. Air removal is affected by two-stage air ejectors exhausting into an inter and after-condenser, which utilizes condensate for cooling water. A starting jet is installed for quick removal of air during plant starting up periods.

Feedwater System

Three of the turbine extraction points are utilized for feedwater heating. The low pressure and high pressure heaters are closed type and the intermediate heater is a deaerating type. The deaerator is provided with a storage tank which acts as the surge tank for the feedwater system. It is located on the roof of the boiler room in order to provide maximum possible static head on the boiler feed pump suction.

Two closed heaters are horizontally mounted, the low pressure heater being an Elliott four-pass unit containing 765 sq. ft. of heating surface. The high pressure heater is a Foster-Wheeler, two-pass unit containing 880 sq. ft. of heating surface. The deaerating heater is Elliott vertical type, equipped with vent condenser and with horizontal storage tank having a water capacity of 50,000 lb.

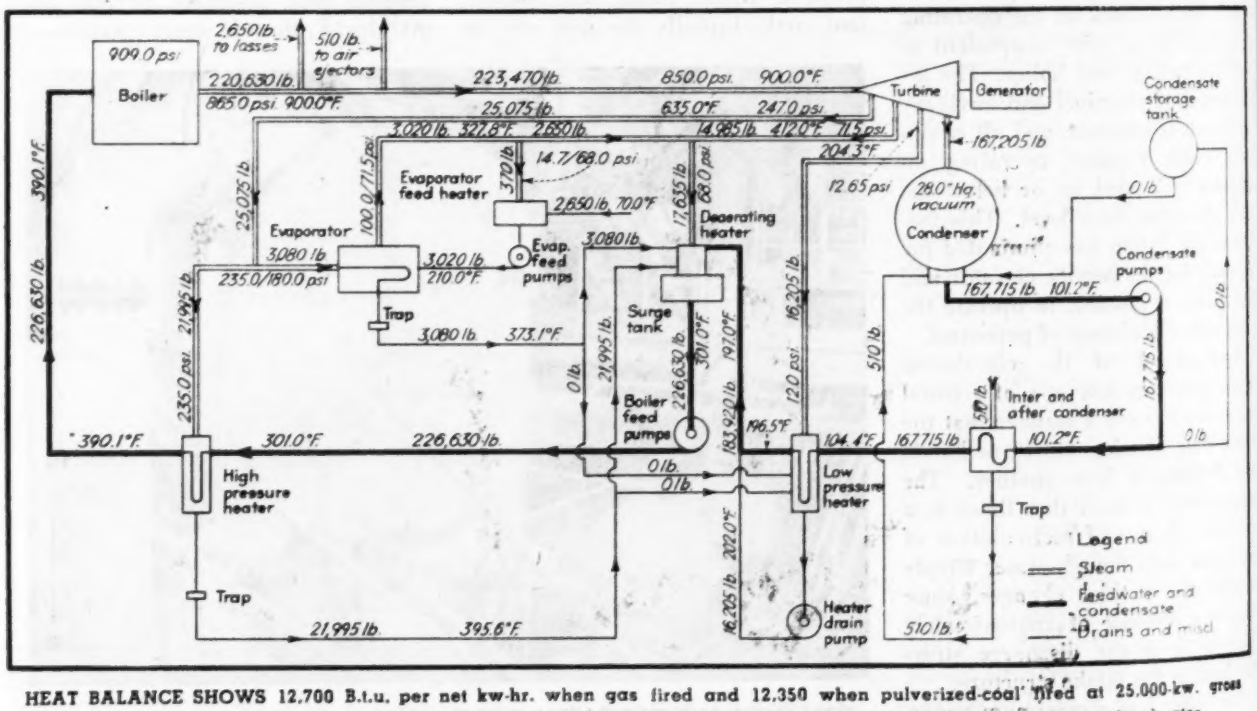
Make-up water is evaporated, a Griscom-Russell Type "R", bent-tube unit being installed which has a maximum rated capacity of 7,500 lb. per hour of vapor. The evaporator has an effective heating surface of 147 sq. ft., and raw water is first preheated and deaerated in a small open type heater before being delivered to the evaporator.

Two Ingersoll-Rand boiler feed pumps are installed, each having a capacity of 550 gpm. of water at 310 deg. F. with a net dynamic pumping head of 2,490 ft. These pumps are equipped with a by-pass for use in starting up. The control valve in this by-pass line is manually operated and is located adjacent to the boiler control board so that it can be quickly reached in event of sudden closing of the feedwater regulator or any other emergency which might stop the discharge of water from the pump and cause it to become steam-bound.

Heater drains are cascaded except during the starting up period and at light load operation when the differential in pressure between the high pressure heater and the deaerating heater does not exceed the static pressure. When this condition exists, the high pressure Foster-Wheeler heater drains are shifted from the Elliott deaerating heater to the low pressure heater, the shift being handled automatically. In emergency or during repairs to individual heaters, any one (or all) of the heater drains may be discharged direct to the condenser.

Electrical Design

Discussion of the generator, bus, station service, protection, cables, transformers and substation will appear in an ensuing instalment.



HEAT BALANCE SHOWS 12,700 B.t.u. per net kw-hr. when gas fired and 12,350 when pulverized-coal fired at 25,000-kw. gross load (evaporator supplying normal make-up only and h.p. heater and evaporator coil drains discharged to deaerating heater

Install Glass Ties on Stator Windings

Impregnated glass cord used to tie 13.8-kv. windings of two frequency changers—Special knots devised to overcome tendency toward breaking of small strands—Doubled strength achieved

P. W. MEINHARDT, Union Electric Co. of Missouri, St. Louis.*

GLASS CORD, vacuum-impregnated with insulating varnish, was selected to replace flax and asbestos ties on the 13.8-kv. stator windings of two 25-60 cycle frequency changers at Page Substation of the Union Electric Co. of Missouri when it was found, during a recent overhaul, that the existing ties were in bad condition. The flax cord was weak, and some of the asbestos ties showed faint traces of corona between windings and ties while some others were loose.

Glass was finally chosen in preference to other materials for the new ties because it not only is a good insulator and will not burn, does not absorb moisture and resists acid, oil and corrosive vapor; but also, spun glass is stronger than other textiles, has high thermal conductivity and being inorganic, is more permanent than other materials. Under test, however, glass cord did show some disadvantages. It was more elastic than asbestos, and on every test it broke at the point of support and not in the center of a length as did asbestos and flax. These factors influenced the manner in which the cord was treated and tied, as will be shown.

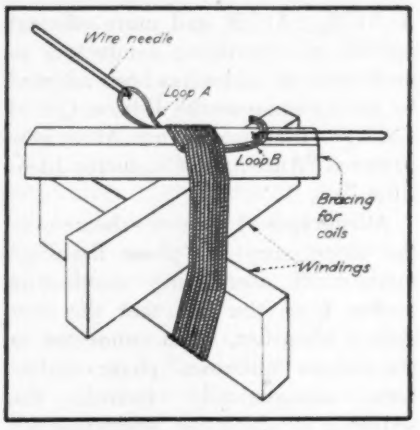
First step was to prepare the glass cord by impregnating it with insulating varnish. This is believed to give it the necessary lubrication to prevent cutting the small strands when it is in contact with an irregular surface. It also prevents cutting when the cord is tied.

Glass cord rolls, as received, were placed in a vacuum tank fitted with a funnel on top piped to the inside of the tank, but with a valve between the funnel and tank. When vacuum had been built up and the pump shut off the funnel was filled with a mixture of equal parts of GE No. 183 and 152 varnish. If too thick it was thinned with GE No. 1500 thinner. Care was taken to open the funnel valve slowly to admit varnish but no air. Varnish was admitted until pressure inside the tank was normal and the glass cord completely covered with the varnish.

In tying the windings a knot was used which will cause the least friction on the glass cord and so prevent breaking the small strands.

Two men were required to make a single tie. One, on the outside of the winding, fished the cord through the windings with a wire needle while the other man, inside, fished it back through the windings. The cord was doubled before the tie was started. Five turns of double cord were used per tie, making a total of ten cords per tie, or about 12 ft. of cord.

Three stator windings were tied in this manner. On one machine, the 25-cycle unit of a frequency changer, 1,248 ties were made and 121 lb. of cord used. On the second frequency changer 624 ties were made on the 60-cycle unit and 1,248 on the 25-cycle unit. A total of 180 lb. of glass cord were used. After the ties were completed they were sprayed with insulating varnish to bind them together and give extra protection.

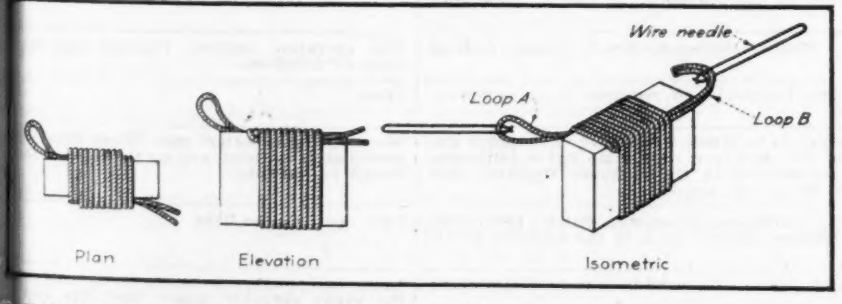


MANNER of knotting glass cord used to tie stator windings

Tests were made of breaking points of various types of single cord with the following results:

	Pounds
Breaking point of new glass cord	230
Breaking point of new asbestos cord	85
Breaking point of new flax cord	115
Breaking point of asbestos cord used on 25-cycle unit No. 2 machine for 6 yr	90
Breaking point of flax cord used on 60-cycle unit No. 2 machine for 6 yr	22

Values of strength tabulated are the average of three tests except in the case of flax which is based on a single test. Tests were made with improvised apparatus and results are not considered precise but are indicative of the relative strength of the various cords. The flax had been in use for six years and was difficult to remove in pieces long enough for test.



KNOTS USED IN TYING GLASS CORD. Loop "A" is made secure by portable support when tying is started. Wire needle on loop "B" is fished back and forth through winding until required number of turns have been made. Needle on loop "B" is then pushed through cord pack and pulled tight. Needle is then put in loop "A" and pushed through cord pack and pulled tight. Ends are cut off flush with cord pack

* Engineer, Substation Department

Cable Conductors Identified by New Automatic Scheme

Automatic conductor identifier replaces similar lamp method of "flashing phases" in underground cables—Device records sequence in which cable conductors are energized, at terminal end—Saves time, contributes to safety and simplifies arrangements between employees

J. L. SMITH, Commonwealth Edison Co., Chicago, Ill.*

A NEW, SAFER and more efficient method of identifying conductors in underground cables has been adopted by the Commonwealth Edison Co. of Chicago, that makes use of a new patented "Automatic Conductor Identifier."

Advantages of the new scheme over the older lamp or "phase flashing" method of identifying conductors accrue from the fact that the conductor identifier, when connected to the various "unknown" phase conductors, automatically records the sequence in which the conductors are energized (with d.c.) at the remote end of the cable where their identity is known. While this process is going on, the man at the receiving end can stay "in the clear," free from any possible danger should the operator at the opposite end make a switching error and energize the cable instead of regrounding it after operations are completed.

*Supervising Engineer, Cable Division

Reduced Operations

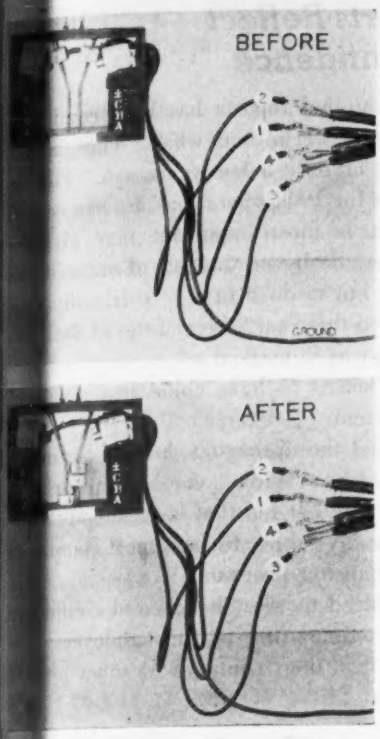
Although the method was developed to provide additional safety, actual use of the new procedure during the past several months shows that it saves considerable time by reducing telephone calls and simplifying arrangements between the men at the receiving end and operators at the line terminals. The time saved and other factors is revealed by the accompanying table comparing old and new methods of identifying conductors.

The automatic conductor identifier, shown, will identify up to four conductors. Four wood disks, numbered 1-2-3-4 are mounted to slide on four vertical wires, so spaced that the disks will pass each other at the upper end but will not pass each other at the lower end. Thus when the disks are released at the upper end they will pile up one on top of the other, in the order that they are released. Each disk is released by the operation of solenoid.

One lead from each solenoid coil is brought out to a common ground connection. The other lead from each coil is about 3 ft. long and has a spring clip at the end. Each clip is numbered to correspond with the disk

Comparison of Cable Identifying Methods

	Former "Lamp" Method	New Method Using "Automatic Conductor Identifier"
1.	Foreman has cable ends opened preparatory to identifying the conductors. Line is grounded at the line terminal during this operation.	Same, except foreman connects an Automatic Conductor Identifier to each conductor of each cable end.
2.	Foreman goes to nearest available public telephone and informs the Load Dispatcher (or System Operator) that he is ready to identify the conductors of line X. (Operation is commonly called Flashing Phases.)	Same
3.	Foreman returns to manhole and prepares to identify the conductors by "lamp" method.	This operation omitted. Foreman may remain at telephone.
4.	Load Dispatcher calls operators at each line terminal and requests them to remove grounds, "flash phases" and re-ground line.	Same
5.	Operator at each terminal connects lamp which is in series with 110-v. d.c. supply and ground to conductor No. 1. He holds lamp on this conductor until lamp lights, indicating that foreman has made contact with this conductor in the manhole. Operator then moves over to the remaining conductors in the proper sequence.	Same, except operators may "Flash Phases" immediately without waiting for foreman to return to manhole.
6.	The foreman, at the time he "receives phases" marks each conductor with an identifying mark. After each conductor is marked he "flashes phases" back to the operator at the line terminal as a final check.	This operation omitted.
7.	Operator, at completion of his work, re-grounds lines and reports back to load dispatcher.	Same, except there is no one in manhole in the event operator makes line alive and burns up end of cable in the manhole accidentally.
8.	Foreman leaves manhole and telephones load dispatcher to determine if line has been regrounded.	Same, except foreman has remained at telephone after his first call.
9.	Foreman returns to manhole and proceeds with work of connecting conductors together.	Same.



CABLE IDENTIFIER automatically records phase identity of the four conductors of an underground cable. *Before:* Ready to identify conductors four numbered disks (only two visible) are held up by armatures of four electromagnets. *After:* Electromagnets have been energized with d.c. applied at cable terminal in predetermined sequence, A-B-C-Neut. Disks released in this order, reading from bottom reveal lead 3 is connected to "A" phase, 2 to "B", 4 to "C" and 1 to Neutral

released by the connected solenoid.

In use, a numbered lead is clipped to each unidentified conductor and the common lead is grounded, usually to the sheath of a cable. As each cable conductor in sequence is connected with a source of d.c., at the line terminal, the coil connected to it at the receiving end is energized and drops the corresponding wooden disk. Let us say that the identifier disks are released and pile up on each other in the order of 3, 2, 4, 1, reading from the bottom. If the conductors are to be identified as phases "A", "B", "C" and "Neutral" and the operator at the line terminal has applied d.c. to them in this standard order, the bottom disk No. 3 will correspond to phase "A". Similarly disk No. 2 wil correspond to phase "B", disk No. 4 to "C" and disk No. 1 the "Neutral" conductor. The corresponding numbered leads will show which conductors should have each phase designation.

Cable-Reel Brake and Turning Device

By A. W. ACKERMAN

Engineer, Public Service Electric & Gas Co., Newark, New Jersey

Two devices have been developed and used very successfully in the Essex Division, Electric Distribution Department of Public Service Electric and Gas Co., to assist in cable salvage work. The present shortage of materials has resulted in salvaging many cable sections which in previous years would have been scrapped. In connection with salvaging the longer lengths of heavy cable there were two major difficulties. The first was to provide a positive means of turning the reel. The second was to provide a positive locking device or brake to hold the reel against the drag of the cable being lifted from the manhole.

The solution to both problems is based on a clamp which was devised to grip firmly the chine of a wood reel. The long handle of the turning device (Fig. 1) provides leverage so that two men can turn the heaviest reel. The hook on the end is of sufficient size to hook over the largest reel

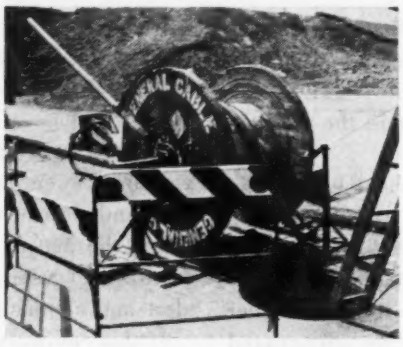


FIG. 1—Field set-up at start of one of the cable salvaging operations

bar used. It is also fitted with a locking bar to prevent falling off. Small clamps on the handle permit adjustment of the operating arm position to suit the diameter of the reel (Fig. 2). By having the clamp grip the sides of the chine the metal protective strip which some manufacturers nail to the outside face can be left in place and the life of the reel thereby extended. This strip has been removed from the reel shown in the photographs and the damage shown is the result of rolling and turning the reel with other devices that tear the wood. The main clamp holds the reel in a grip which increases as more pressure is applied to the handle. A stop is provided which holds the clamp in a neutral

FIG. 2—Band clamps permit adjustment to accommodate various reel diameters. The jaws of the swinging clamp grip the sides of the chine along the metal protective strip (here removed to show how other devices may tear the unprotected wood)

position when the handle is being raised. In this way the clamp slides along the chine as the handle is raised and re-sets itself automatically ready for the next pull.

While re-setting the turning device for another pull it is necessary to hold the reel against the drag of the cable being lifted out of the manhole. The brake used consists of the same clamp, made up of heavier material to withstand the shock of braking a loaded reel and mounted on a three-legged stand. The height of the brake head is adjustable to different reel diameters. A stop is provided (Fig. 3) to prevent the clamp from going above a horizontal position and catching on the reel as it is turned.

The use of the two devices together produces a smooth reeling operation with a minimum expenditure of effort.

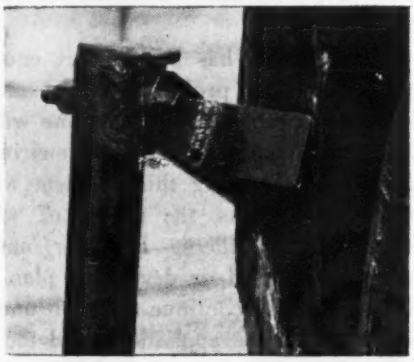


FIG. 3—Stop prevents clamp jamming when shifting position

Editorials

S. B. WILLIAMS, *Editor*

The Challenge of Rewiring the Old House

ADEQUATE WIRING after years and years of effort is finally beginning to take hold in a big way. Reports of activities and interest in one place after another which are rolling in to the Adequate Wiring Bureau are most encouraging. It is a new home activity, however. What about the old home, the home that has electric service but is limited in its future use of electrical equipment by the inadequacy of its wiring? Here, in what perhaps presents the biggest opportunity for everybody in the electrical industry, lies a challenge that should stimulate our best thinking.

In the past, several people contending that the problem was primarily one of cost and muss have offered surface wiring systems, some having considerable merit. Still none of them made any appreciable dent in the residential rewiring market.

It is true that cost is an important element in creating a rewiring market, but the introduction of new wiring methods and materials is not the only way of effecting substantial cost reductions. This does not mean to imply that new methods which will be acceptable to the customer should not be encouraged; they should be encouraged provided they give in appearance and service a job equal to that in a new home.

More important than anything else is the creation of a sound merchandising approach that will produce volume sales sufficient to permit production wiring methods. It's a mass selling and a mass installation problem. Done that way, sales and installation costs can be held down to a minimum.

The industry has been smart enough before to lick many marketing problems that meant volume sales, and sometime, perhaps soon, someone will find the key that unlocks the door to residential rewiring. Some areas are already approaching this problem with new and interesting promotions, the results of which should prove stimulating to others. However, until the majority of communities find or develop a plan for mass rewiring sales, there will continue to be an unnecessary barrier to the sale of home appliances, and the industry will have fallen down just so much in fulfilling its responsibility to post-war employment.

Annual Reports Reflect Renewed Confidence

A NEW FLOCK of annual reports has been coming during the past several weeks and what a change from the dull dry reading of only a few years ago. For most part the reports for 1944 operations are newsy, illustrated and what is most important they give impression of a sincere desire on the part of management not only to "tell all" but to do it in a very friendly

Another thing noted this year is very little of the plaining attitude that was so marked not so very long Instead a new note seems to have come in—a note pride of accomplishment.

Likewise, one sensed the upsurging show of assurance with respect to the future. While some loss in war is expected, it is not so great but that it can be absorbed by other loads reasonably soon. In fact, most companies are talking about expansion programs.

It is heartening indeed to see this renewed confidence and it will be most stimulating to the employees who naturally will reflect it in their contact with other people

Employee Lower Age Bracket

IN REFERENCE to the editorial in the previous issue entitled "Staffing for Tomorrow" our attention has been called to a paragraph in the remarks made by the president of the Consolidated Edison Co. of New York at the annual meeting of the stockholders last month showing the seriousness of the problem.

"There is right now," Mr. Tapscott said, "a distinct gap in the employees' lower age bracket—only 21% men and women of our present force of over 23,000 are below the age of 35. This gap must be filled by these (returning) veterans in order to insure a continuity of alert and competent management in the years to come."

If this company's experience is at all comparable with that of the rest of the industry the situation is probably even more serious than these figures would indicate because it is reasonable to assume that the proportion of men below 35 would be smaller than for women. With well above 90 percent of the male employees more than 35 years of age it is obvious that the industry has a problem that requires some well thought out planning. In fact, this situation has been characterized by a professor of utility management at one of our foremost eastern universities, and well known as an authority on utility economics, as "one of the most important problems concerning the electric light and power industry."

While the industry can expect considerable relief from the thousands of returning veterans, the long range solution of the problem of staffing for tomorrow goes much deeper. Not all of the returning service men will go back to their former jobs especially those of initiative who think they will have greater opportunities elsewhere. A great many, particularly the younger ones and those who are looking for something better, will take advan-

age of the G.I. Bill of Rights to complete or extend their education. Will they see an opportunity in the utility business?

Beyond the returning veterans there is still the larger problem of revitalizing the industry with young men. Over the past decade and a half far too few young people of education on whom the industry must depend for future management have been recruited. If we take the figures of the company above cited as indicative of the industry as a whole, it will be found that if all those still in service return to the jobs, less than 30 percent of the total employment will be under 35 years of age. Is this safe?

For several years all industry will have to compete for the young college graduate. Nor is starting pay going to be the most attractive bait in all instances. Opportunity will have a large pulling power. Now is the time to analyze what the future does hold in the business for men seeking a career and to establish policies and goals that will attract youth.

To Ground or Not to Ground

GROUNDING OF LOW-VOLTAGE CIRCUITS and equipment is largely mandatory and the reason is that it tends to guard against abnormally high voltages that might endanger life or property. Grounding of higher voltage circuits when they are presumed to be de-energized for maintenance or construction operations is done with a similar objective. But a new angle enters the pattern and it is simply that the very act of establishing the protective ground may present more hazards than would exist if other precautions than grounding are taken. That explains why there are two schools of thought in present utility practice.

Much of the justification for not applying protective grounds when working on presumably de-energized circuits rests on the realization that the older installations may have been designed without as much consideration being given to the inevitable maintenance operations as to the normal operating requirements. Some of the compact and congested installations of recent design may even lack the spacings and clearances necessary to permit the application of enough protective groundings to guard against exposure to harmful voltages. Provision should have been made in such instances for adequate working space not only to do the work on the "dead" circuits but to be able to apply the grounds so that the circuits would be truly dead.

If, therefore, the basic program is one of grounding rather than not grounding, there are several ramifications to consider. Are constructions at different points such that a uniform, standardized procedure can be followed? Are the means for grounding reasonably uniform or must practices vary from place to place? Has an effort been made to identify and unify the points at which grounds shall be applied? Is the authority to apply and remove the protective grounds centralized and recognized? Shall a safe form of test be made to assure that the circuit is practically free of voltage before the ground is applied? Must the operator use rubber gloves when he applies the ground?

It is those who sense all these factors who are advocates of not grounding. But they, in turn, need to obviate the risks by equally positive alternative methods. Configurations of disconnects, breakers and buses and the back-feed and induction possibilities should be evident and simple. Hold-off procedures must be rigorous and fool-proof.

In short, anyone considering a possible shift in his attitude toward grounding or not grounding for protection of working crews would do well to canvass a wide array of factors before switching his policy.

Sleep Is the Next Load Builder

COMING UP over the horizon, pretty well up already in terms of technical development, is what seems to be the ideal residential load builder. Its demand on system capacity is definitely off-peak. Its load factor is low, but its connection is intermittent over a fairly long time period and therefore it has a high diversity factor. Not one, but two or more, can be used in the average home. Its users are enthusiastic about it and its sales will be pushed by the most powerful and effective form of advertising, word of mouth. So say its protagonists.

This paragon of load builders is the electric blanket. Some few, about 80,000, were made and sold before the war. It is from experience with these, as well as additional knowledge gained in the manufacturing of aviator's heated suits during the war, that the rosy picture of post-war potentiality derives.

But there is a clash of color in the picture, or, rather, many people will see in it a violent red signalling "Danger," while others will say no such color is there. Abandoning metaphor, let us say that a lot of folks are going to be afraid of the electric blanket, afraid of shock, afraid of burning, from it. The idea of sleeping under a blanket connected to an electric circuit does take some getting used to. But probably many of those who would feel such fear have, on occasions of ache or pain, gone contentedly to sleep with electric heating pads nestled here or there against their frames.

Actually, of course, there is no reason in the world why the circuit of an electric blanket cannot be engineered for as near perfect safety as can be found anywhere else.

Three manufacturers are getting ready to go on the market as soon as they have the green light. Others will probably enter the field. It is anticipated that the blanket will be available in a wide range of prices, from the purely utilitarian form to the luxurious prop of a De Mille bedroom scene.

In specific terms of load building, the blanket will be a real performer. It will take about 200 watts and records show that it will use 100 kilowatt-hours per year more or less, according to climate.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Wickard Accused of Being Private-Utility Man

THE TWO PRINCIPAL REASONS why Senators should vote against the confirmation of Claude Wickard for administrator of the Rural Electrification Administration — according to those who are leading the fight against him—are that his record as Secretary of Agriculture demonstrates his incompetence, and that Wickard is "believed to be a private utility man."

Considering the latter allegation first, the suspicion arises that those who hurl this charge are engaging in politics—the very thing for which they vigorously condemn Wickard as having foisted upon REA. Such a charge is not politics, perhaps, in the vote-buying, election-rigging sense of the word. Certainly it is politics in the sense that it is a red-herring calculated to prevent confirmation of an appointee.

Area Coverage

Wickard is just enough of a private utility man to have told a co-op audience in Wisconsin last summer that electric utilities should not be allowed to build lines which fail to serve every consumer in a given area. He is enough of a private utility man to have seized upon and campaigned for REA's "area coverage" principle, under which returns from good rural areas would be applied against the costs of serving unprofitable rural areas, so that all people in a given section might be served.

Wickard, it will readily be determined from a study of the record, is one of the men who has had considerable to do with promoting the Lucas bill to give REA another $505,000,000 with which to finance lines into territory that might otherwise be served by privately owned utilities. Is there anyone who believes it would be hard to find a more effective basis on which Wickard could demand a reward for services rendered to the privately owned electric power business?

The charge that Wickard is "Believed to be a private utility man" is contained in a telegram sent out by his opponents to drum up messages of opposition which were to be sent to senators. Basis of the charge was a quotation from a statement made by Wickard on April 2, when he testified before the Senate Agriculture Committee on the Lucas Bill. According to the printed transcript, Wickard said:

"If the private utilities will do the job of electrifying rural America, let them do it. That is what I would like to see. If they will go in and take the whole area and give everybody electricity in the area at a reasonable cost, let's help them in every way we can to do it, because that relieves us of the responsibility and it relieves us of advancing those funds."

The anti-Wickard telegram cited the following quote:

"If the private utilities will do the job of electrifying rural America, let's fold up right now. That is what I'd like to see. Let's help them in every way we can to do it, because that relieves us of the responsibility and it relieves us of advancing those funds."

The original transcription of Wickard's testimony, a copy on which no witnesses had made corrections, shows Wickard's first sentence to have ended with the phrase "...let's fold up right now," rather than the phrase ..."let them do it." But the telegram leaves out a rigid qualification which Wickard made.

By all this the Wickard opponents, contrary to expectation, succeeded in delaying Wickard's confirmation, forcing public hearings June 11. It is still doubtful that they can force his rejection, for the "honeymoon" aspects of the President's relations with Congress, which Mr. Truman has cultivated assiduously, still prevail and only recently were sufficiently strong to prevent a knock-down-and-drag-out floor fight on David Lilienthal, as TVA director, by Sen. Kenneth McKellar.

Regarding the assertion that Wickard has demonstrated himself to be too incompetent an administrator for the REA job, the record is not so clear. He was replaced recently as Secretary of Agriculture while other Roosevelt cabinet appointees were retained. Numerous important divisions of the department had been transferred from Wickard's control to the War Food Administration. Still, REA has brought electric service to many rural users in its five years under Wickard.

REA Investigation Obscure

As regards the evidence brought out in the 1944 REA investigation, which his opponents say is, in itself, enough to disqualify Wickard, the record is even more obscure. He was close to the National Rural Electric Cooperative Association, which may or may not be a sin, but not so close as to accept NRECA's plan for co-op-financed insurance companies. He did pick the president of one of REA's worst-managed co-ops for deputy and acting REA administrator, but when that man, William J. Neal, is attacked these days, it is on the basis of his co-op's record, not on the basis of the job he has done at REA in the last two years. With this there is little audible complaint. The 1944 investigation, it will be remembered, was no model of dispassionate, two-sided inquiry.

Wickard did by-pass Slattery completely, in a manner distinctly not contemplated by the letter of the REA act; but not even Slattery's friends argue that he was the administrator REA needed.

Whether or not Wickard is a poor administrator and whether or not REA under Wickard would be a political nightmare, it is apparent that Wickard's appointment has not settled the fight which has raged over this agency for several years. The appointment merely has thrown new fuel on the flames. Some day, those who would bleed and die to save REA from "the power trust" may get around to saving it from themselves.

NEWS OF THE WEEK

Construction Restrictions Lifted under Amended U-1

Falck Wins Battle to Allow Erection of Any Utility Facilities, Other Than Buildings Costing over $25,000, without OWU Authorization—Move Is Toward Winding Up Affairs of OWU as Autonomous Agency

Order U-1 has been amended to allow the construction of any utility facilities—other than buildings costing more than $25,000—without prior authorization from the Office of War Utilities.

Existing priority rating patterns set up in the May 12 amendment—AA-1 for projects whose net material cost is $10,000 or less, AA-3 for projects from $10,001 to $25,000 and for extensions to consumer premises regardless of value—were retained. Construction whose materials are valued at more than $25,000 must be done without ratings unless priorities are granted by OWU after application for them. In removing the restrictions on construction, OWU also withdrew all stop orders ever issued against specific plant additions.

OWU Director Edward Falck, who has been trying for some weeks to obtain authorization for this unrestricted construction policy, estimated that it would result in utility construction valued at $1,630,000,000 in 1946, but predicted that it would not add more than $40,000,000 to the utility construction anticipated for 1945.

Building construction is the only utility construction remaining under wraps as a result of Falck's successful fight to junk construction controls. Buildings using less than $25,000 worth of materials may be erected without authorization, but no ratings will be allowable unless specifically assigned.

The move was another long step in Falck's program of winding up the affairs of the Office of War Utilities and shutting up shop as soon as possible. It was not expected to be followed by any immediate personnel dismissals since so many OWU employees are anxious to leave that the reduction in force can be achieved by releasing these people. OWU, as an autonomous agency, however, is well on its way out.

Coincident with the amendment, Falck directed OWU division heads to speed review of pending WPB-2774 applications. It is hoped that by mid-June, all such applications either will have been authorized and rated or will have been returned with a notation that they are authorized under U-1 but that no ratings will be assigned them. None will be denied unless it runs afoul of the limits on commercial buildings.

Numerous other changes, of less importance, were made in the latest version of U-1. A provision has been added to Paragraph (e) prohibiting the ordering of material for major plant additions in greater quantities than or for delivery on dates earlier than required for actual construction. Formerly, this restriction was included in Form WPB-2774, on which major plant additions were authorized.

Another paragraph was added to U-1 which allows the use of material from excess inventory on unrated construction projects provided it is not replaced by a rating assigned in U-1. This does not allow the use of materials from PWM inventory on unrated projects.

Addition to Paragraph A (11) (VI) provides that purchases for major plant additions may be segregated from other inventory, and need not show on inventory records. Restrictions on deliveries and inventories remain unchanged to prevent stockpiling or purchase other than for immediate use.

Another section has been inserted explaining the uses to which Form WPB-2774 should be put now that major plant additions no longer need be authorized thereon.

The form hereafter should be used to:

1. Obtain priority ratings for major plant additions and buildings under $25,000 which are considered so essential as to warrant priorities.

2. Apply for authorization to construct buildings valued at more than $25,000.

3. Make application for up-rating of rated projects or to apply for other forms of priorities assistance.

An OWU official emphasized, with relation to item 3 above, that OWU general policy would be to deny priorities assistance for bottleneck items which may delay completion of unrated projects.

The prohibition in Order U-1 against building duplicating facilities was removed, but the prohibition against subdividing jobs to bring them under the $25,000 ceiling on rated construction was retained.

Falck Explains Change

"The time has now come," Falck said, "when the stringent programming of utility expansion by OWU is no longer either necessary or desirable. Since V-E Day, it has become clear that the types of materials required in the installation of utility facilities are no longer in short supply for the most part. Manufacturers of specialized power equipment, such as turbines and boilers, now have open shop capacity, as a result of military cutbacks, sufficient to take care of all utilities requirements with margin to spare. Permitting utilities to place orders for such materials on an unrated basis, therefore, creates no important competition with essential war production or construction and follows the WPB policy of removing controls on industry as rapidly as war conditions permit.

"Additionally, because of the long lead time inherent in most major utility expansion, it appears highly desirable to permit utilities to proceed to

expand their systems and to get started on the large volume of maintenance and reconstruction work which has been deferred in recent years by war-time controls. Only if this is done now can it be assured that utilities will be in a healthy condition to service industry and civilians after the war."

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Washington P.U.D.'s Take Over Utility Properties

Supported in their action by a Washington State Supreme Court ruling which refused to halt the sale of revenue bonds for purchase of the properties (ELECTRICAL WORLD, April 21, Page 10), the Okanogan and Douglas Counties Public Utility Districts recently took over the distribution systems of Washington Water Power Co. in Okanogan and northern Douglas Counties.

Prices paid by the districts were $2,314,240 by Okanogan and $167,096 by Douglas, both prices representing condemnation awards made several years ago, plus betterments since made by the company, interest and costs. The Okanogan revenue bonds were handled by Ballard Hassett of Des Moines while the Douglas financing was provided by the Rural Electrification Administration.

In both instances, properties taken over by the districts represented no more than a small portion of the company's total business. In fact, utility officials stated, company territory included within all public utility districts now organized produces less than ten percent of the total company business.

Paul W. Hand, formerly of the Seattle and Portland offices of the Bonneville Power Administration, has been hired as manager of the Okanogan P.U.D.

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Completion Date for Ross Dam Extended to June '46

Extension of the completion date for Seattle City Light's Ross Dam power project to June, 1946, was granted contractors in mid-May by the municipal Board of Public Works. Delay of one year before electrical energy will flow from the development on the Skagit River in northwestern Washington was necessary because of manpower shortages and a high labor turnover.

Disposal of millions of feet of marketable timber in the Skagit Basin which will be covered by Ross Dam Lake was still a question for city officials. One bid for the timber had been received though no action had been taken.

Association Changes Name to Gain Clarity

That the name of the organization may more clearly identify its members as manufacturers of residential lighting fixtures, the American Lighting Equipment Association will operate in the future as the American Home Lighting Institute. The basic policies and objectives of the original organization will be retained.

A 16-point post-war program of education and promotion designed to revitalize and expand the market for overhead residential lighting was adopted

Willard G. Sawyer

at a recent meeting in New York. The theme will be "Overhead Lighting for Better Living."

Incorporating a certification plan that will include the Illumination Performance Recommendations of the Illuminating Engineering Society, and will encourage design of fixtures that will contribute materially to the elevation of home lighting standards, the new program provides for cooperation with all industry interests in broadening the market and bringing to the public the combined benefits of united action. The program was developed by George E. Glatthar, president of the Art Metal Co.

Willard G. Sawyer, president of John C. Virden Co., Cleveland, was elected president.

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TVA Road Case Closed

The Supreme Court denied an application for rehearing of the contention of Jefferson County, Tenn., that it should be reimbursed for county roads submerged by construction of Douglas Dam by the Tennessee Valley Authority.

Recently, the court refused to review the case, in which TVA returned the county road system to the degree of usefulness it attained before construction of the dam, but did so with a net loss of 84 miles of road.

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SEC Loses 2 Cases Heard by High Court

The Securities and Exchange Commission suffered a double setback from the Supreme Court this week when the court ruled favorably to the American Power & Light Co. and to Samuel Okin in two cases dealing with the rights of stockholders to litigate on orders affecting the company in which they have invested.

The high court:

1. Reversed an opinion of the Fifth Circuit Court of Appeals which had upheld an SEC order directing the Florida Power & Light Co. to remove $1,815,677 from its surplus and to appropriate $700,000 yearly from its surplus until approximately $10,000 had been so appropriated. A. P. & L. had appealed as sole stockholder of F. P. & L.

2. Affirmed a ruling of the Second Circuit Court of Appeals which denied a motion by SEC to dismiss Okin's petition for review of an SEC order approving a transaction between Electric Bond and Share and its subsidiary, American & Foreign Power Co. When SEC approved an E. B. & S.—A. & F. P. transaction whereby A. & F. P. refinanced a $35,000,000 note held by E. B. & S. by paying $5,000,000 in cash and giving E. B. & S. new notes for $30,000,000 at a reduced rate of interest, Okin claimed it affected the value of his 9,000 shares of E. B. & S. stock. SEC insisted that he was not a "person aggrieved" under the meaning of the Holding Company Act.

The court declared that:

"We hold that a stockholder having a substantial financial or economic interest distinct from that of the corporation which is directly and adversely affected by an order of the commission, irrespective of any effect the order may have on the corporation,, is a 'person aggrieved' within the meaning of Section 24 (a) (of the Holding Company Act)."

Majority opinion was delivered by Mr. Justice Roberts. Mr. Justice Murphy dissented from the majority opinion with regard to both cases. Mr. Justices Black and Reed concurred in the majority opinion with respect to the SEC-vs. Okin case, and concurred with Mr. Justice Murphy in his dissent from the A. P. & L. decision. Mr. Justice Douglas took no part in consideration or decision of either case.

Move Underway to Give REA More Funds for '46

Program Would Provide More Money for Rural Lines Than Is Allowed by Lucas Bill Which Could Be Shelved in Committee to Keep REA Under Agriculture—Opposition to Wickard Nomination to Head REA Develops

The week's developments in Congress with respect to the Rural Electrification Administration were important and varied, and included:

1. Development of effective opposition to the confirmation of Claude Wickard's nomination as REA Administrator.

2. Development of a program, with Presidential support, which will give REA more money to expend on rural lines in fiscal 1946 than it would have received under the Lucas Bill, meanwhile allowing the shelving in a House committee of the Lucas Bill and its Shipstead amendment re-constituting REA as an independent agency.

Opponents of Wickard, who stepped down as Secretary of Agriculture to take the REA job, succeeded in forcing public hearings on his nomination. These will be held June 11, a date sought by Wickard opponents so they could prepare their arguments against him. Chairman Elmer Thomas of the Senate Agriculture Committee, which will consider the nomination, had hoped originally to push the nomination through in executive session.

Thomas indicated that opponents of Wickard would face some questioning themselves when he declared that there is evidence of "a propaganda campaign" against Wickard. He said that "many of the telegrams against him (Wickard) were similarly worded and apparently someone is telling them what to say."

Will Call Co-op Representatives

Thomas said representatives of a number of co-ops opposing Wickard will be called upon to testify, among them Earl Murley, manager of an Indiana co-op.

Despite the unexpected holdup in Wickard's confirmation, there was little real feeling that Wickard ultimately would be refused confirmation.

Meanwhile, it became apparent that the Lucas Bill, giving REA $505,000,000 for three post-war years and divorcing it from the Agriculture Department, is just about dead because of the independence provision. It has been predicted widely that the bill would never come out of House committee, and Speaker Rayburn told a press conference flatly that the House would not approve it with the independence amendment.

An Agriculture Department spokesman told ELECTRICAL WORLD this week that President Truman has sent to Congress a request for a deficiency appropriation of $160,000,000 in loan funds for fiscal 1946 and an additional $850,000 for REA administrative expenses. This sum, plus the $80,000,000 loan funds which REA has for next year under the fiscal 1946 Agriculture Appropriation Bill, is more than REA would have had next year even under the Lucas Bill which would have given REA $105,000,000 plus the already-appropriated $80,000,000. All this, of course, is in addition to the $100,000,000 backlog of allocated but unexpended funds which REA freed when U-1 was amended May 12.

If the backlog be included, and the deficiency request of $160,000,000 be approved, REA will have for their expenditure between May 12, 1945 and June 30, 1946, a total of $340,000,000. Only $240,000,000 of this would represent lines not previously approved.

REA asked for a deficiency appropriation of $230,000,000 for 1946 but this amount was cut to $160,000,000, it was learned. The request followed the V-E Day amendment of Order U-1, which took most of the controls off the type of lines REA builds. Last Saturday's amendment, open-ending utility construction other than commercial buildings, will remove the final wraps which had been on REA construction and allow the allocation of as much money as REA can disburse. Few believe at this time, that co-ops will be able to build anywhere near as much line as REA will be able to finance in fiscal 1946.

One factor in asking such a large deficiency appropriation, it was learned, was the speed with which co-ops applied for loans from the $80,000,000 appropriated for fiscal 1946 in the Agriculture Bill. Shortly after the bill was signed and weeks before the funds were to become available, on next July 1, $40,000,000 of the 1946 fund had been earmarked for allocation on July 1. At one point since V-E Day, an Agriculture official said, co-op loan applications were coming in at the rate of $1,000,000 a day.

If the deficiency appropriation passes, and it is expected to without too much trouble, although it may be reduced in size, there would be no reason for those who advocate keeping REA in the Agriculture Department to press for passage of the Lucas Bill. At the rate co-ops are applying for funds, the plan-

Hartford Courant

PUBLIC SERVICE TRIBUTE—Clarence W. Mayott, who has returned to his duties in the technical division of Hartford Electric Light Co. after almost three and one-half years with the Office of War Utilities and its predecessor organizations, was honored recently at a dinner in Hartford. Utility leaders who attended the dinner included OWU Director Edward Falck, left; Col. H. S. Bennion, managing director of Edison Electric Institute; Samuel Ferguson, president of Hartford Electric; Mr. Mayott; Clyde O. Fisher, Connecticut public utilities commissioner; and Tom P. Walker, president of the Council of Electric Operating Companies

ning provisions of the bill seem not to be needed. Thus, the desirable functions of the Lucas Bill from Agriculture's point of view, would be attained, on approval of the deficiency request, without the embarrassment of a floor fight over independence for REA.

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Scott Leaves FPC; Smith Unconfirmed

President Truman was expected to move rather quickly this week in naming a successor to John W. Scott who resigned last week as a member of the Federal Power Commission after eight years' service.

The Senate, meanwhile, had before it for confirmation the nomination of Commissioner Nelson Lee Smith, of New Hampshire, for a five-year term. Smith was confirmed in October, 1943, to fill the unexpired term of the late Commissioner Clyde L. Seavey. It was not anticipated that Smith would encounter much if any difficulty in obtaining confirmation, but how quickly the committee would move, since its chairman, Sen. Burton K. Wheeler, Montana Democrat, is in Europe, was not immediately clear.

First candidate for Scott's unexpired term of two years was Roger B. McWhorter, since 1930 chief engineer for the commission. A civil engineer, McWhorter worked on the Hales Bar and Muscle Shoals Dams, for eight years was assistant and division engineer on the Miami Conservancy District in Ohio, and became general superintendent of construction of Wilson Dam at Muscle Shoals. He was U. S. Engineer on the St. Lawrence Waterway in 1925 and 1926, and after considerable flood control work on the Mississippi River for the Corps of Engineers and the City of New Orleans, he became chief engineer for FPC in 1930.

It was rumored that an Arkansas man was under consideration. It was possible that this was in reference to Thomas Fitzhugh, Arkansas attorney and former chairman of the Arkansas Commission. Fitzhugh, now in service, also was general counsel for the National Rural Electric Cooperative Association.

Scott will be associated in Washington law practice with William M. Boyle, Jr., who was a counsel for the Truman war investigating committee.

Scott entered federal service in 1935 when he became special assistant to the Attorney General in charge of utility matters. In 1937, he was appointed to FPC for the term expiring in June, 1942. He was reappointed for a second five-year term in 1942.

T & D Problems, Pole Treatment Discussed

P.E.A. Committee Hears Talks on Rural Line Construction and Wood Preservation Methods

Treatment of poles and cross arms and comparisons of various types of construction and the resulting line operating records were discussed at the Pennsylvania Electric Association transmission and distribution committee meeting, May 23 and 24, in Lancaster.

Dr. J. P. Wentling, wood technologist of the Consolidated Treating Co., presented a paper on wood preservation in which he traced the development of the art to its present stage. Discussion on rural line construction was led by Clyde Moler, Potomac Edison Co., and B. Hughes, of Hughes Bros., described and showed slides of various methods of supporting static wire on wood H-structures when no provision was made for it in the original construction.

Wentling stated that in the nonpressure process the best results were obtained by soaking, second best by spraying and that brushing was least satisfactory. In the pressure treatment, he continued, the empty cell process is favored over the full cell process. In the former, the excess materials are removed from the exterior cellular layers of the pole and thereby eliminate bleeding. He showed several microphotographs which traced the development of decay and the means by which this decay was arrested.

"Drive-Pin Construction" Economical

In the rural line discussion, Mr. Moler explained the "Drive-Pin Construction," stating that it appears to be one means of reducing rural line costs without sacrificing quality of construction or service. It consists of a 11-in. by ⅞-in. steel pin which is driven into the pole at an angle of 45 degress. Horizontal separation of about 15 in. and overall separation of approximately 40 in. results with pins on opposite sides of the pole and 36-in. vertical spacing.

W. H. Jones, Philadelphia Electric Co., in reporting on the P. E. A. distribution transformer lighting survey stated that the fuse blowing rate for unprotected transformers increased from 13.18 per 100 in 1943 to 22.00 in 1944 and that the transformer failure rate increased from 0.92 to 1.39. A certain company reported that field inspection of fuses and the adding of oil to transformers in service reduced its fuse blowing rate from 33.5 to 12.6 per 100 transformers.

Discussion of steel vs. wood for transmission structures brought forth such divergent remarks as: (1) "From an economic viewpoint, other conditions being equal, wood has the advantage over steel on lines up to 132 kv." and (2) "If the line is of prime importance and continuity of service is the first consideration steel has the advantage over wood in some cases on voltages as low as 6.9 kv."

Progress was reported in the cooperative study of E. E. I. and Air Conditioning & Refrigerating Machinery Association on the starting current problem of motors on room coolers and food freezers. J. W. Anderson, Philadelphia Electric Co., chairman of the committee, stated that the problem resolves itself into finding a means of shrinking possible flicker voltages of 30 to 40 volts to permissible values of 3 or 4 volts.

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OWU Gives Utilities Installation Approvals

The Office of War Utilities has approved these capacity installations:

Scranton Electric Co., 34,000-kw. unit and a 300,000 lb. per hr. boiler for its suburban plant.

Mississippi Power Co., 22,500-kw. unit with a 230,000 lb. per hr. boiler for its Eaton plant near Hattiesburg.

Long Island Lighting Co., 35,000-kw. condensing unit and a 410,000 lb. per hr. boiler.

City of East Palestine, Ohio, 25,000-kw. unit and a 35,000 lb. per hr. boiler.

City of Glendale, Calif., 20,000-kw. unit and a 20,000 lb. per hr. boiler.

Southwestern Gas & Electric Co., 20,000-kw. unit for its Caddo Lake plant.

City of Washington, Ind., 5,000-kw. unit and a 20,000 lb. per hr. boiler.

City of Dover, Ohio, 4,000-kw. unit.

City of Norwalk, Ohio, 4,000-kw. unit and boiler.

City of Portland, Ind., 5,000-kw. unit and 10,000 lb. per hr. boiler.

Kentucky Utilities, Co., Tyrone, Ky., 25,000-kw. unit and two 150,000 lb. per hr. boilers.

Detroit Edison Co., a 75,000-kw. unit and boiler, to be No. 8 machine at its Marysville Plant.

Federated Cooperative Power Association, 15,000-hp. diesel with auxiliaries, substation and transmission line for its Butler Plant near Allison, Iowa, and an 11,020 hp. diesel with auxiliaries, substation and transmission line for its Grundy Plant near Dinsdale, Iowa.

Millville Manufacturing Co., Millville, N. J., 5,000-kw. unit and auxiliaries.

Hydro Commission Placed under Quebec Government

Act of 1944 under Which Properties of Montreal Light, Heat & Power Were Expropriated Is Amended—Shareholders Must Surrender Stock as Government Sets Up System for Payment—Liberals Oppose Move

Quebec Hydro Electric Commission passed under complete control of the government of the province last week as the National Union bloc of 47 votes in the Legislative Assembly fought off all opposition and amended the Hydro Electric Commission Act under which the government in April, 1944, expropriated the properties of the Montreal Light, Heat & Power Cons.

Under the new legislation all of the capital stock of the Montreal utility and of its subsidiaries is to be expropriated as the properties themselves were last year but machinery for indemnifying the stockholders is provided.

The bill has already been approved by the Legislative Council but only on division on both second and third readings. That the question is far from settlement politically was indicated by the acrimonious debate in the Assembly as the Liberal Party which sponsored the original act in 1944 under ex-Premier Adelard Godbout fought to block the new measure. Though given the support of two minor parties, the Liberals could muster but 40 votes to oppose the bill sponsored by John S. Bourque, Minister of Lands and Forests, and backed by the National Union Party of Premier Maurice L. Duplessis.

Arbitration Committee Proposed

Long and involved, the bill provides for the expropriation of all shares of M. L. H. & P., Montreal Island Power Co., and the Beauharmois Light, Heat & Power Co. Quebec Hydro will make an offer to the companies and if this is not accepted within 60 days then expropriation proceedings will commence before a board of arbitration of three members—one appointed by Quebec Hydro, one by M. L. H. & P., and one by the chief magistrate of the province. The award may be revised by the Court of King's Bench, but the decision of this court will be final and without appeal.

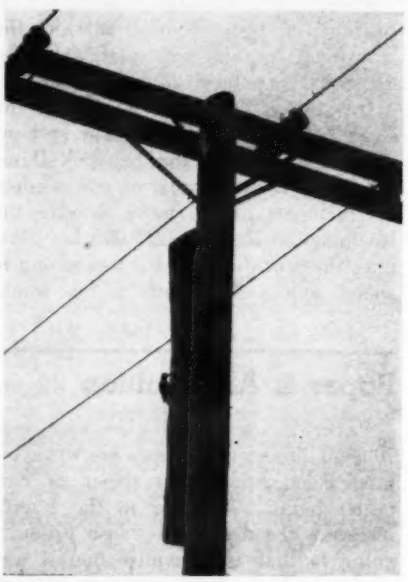
Payment of the indemnities need not be in cash but with the approval of the lieutenant-governor-in-council may be by means of bonds. "Such payment shall be equivalent to a payment in cash up to a sum equal to the nominal value of the bonds."

The procedure for the issuance of the bonds is as follows:

"The lieutenant-governor-in-council may authorize the Quebec Electric Commission to contract loans for an amount not exceeding in each case the expropriation indemnity, by means of bonds bearing interest at a rate not exceeding three and one-half percent per annum for a term not exceeding 30 years and payable on such dates and in such manner as he may determine."

The lieutenant-governor-in-council is authorized to guarantee payment of such bonds in principal and interest.

As originally set up Quebec Hydro was an independent agency similar to the Hydro-Electric Commission of Ontario on which it was patterned. The Liberals had intended that Quebec Hydro would provide electricity at low rates to the people and to industry so that the province would be in a favorable position to compete with its neighbor, Ontario, for industries.



SOUTHERN HOSPITALITY—Whenever woodpeckers destroy a pole in the Mississippi Power & Light Co. district at McComb, Miss., Superintendent V. K. Smith has the top of the old pole containing the nests of the birds sawn off and bolted to the new pole. Since the experiment began the birds have been satisfied and have not bothered the new poles

Under the new legislation, Quebec Hydro becomes an agent of the government, such as the Quebec Liquor Commission, and the $9,000,000 profit made in the first eight months since expropriation of the business-managed utilities is to go to the Provincial Treasurer to form part of the consolidated revenue fund. Since the rates for electricity must now be approved by the lieutenant-governor-in-council, or in other words the government, opponents of the measure see the electric system being used as a source of revenue in the future instead of as a means of giving consumers cheaper electricity.

Further control by the government is given by clauses which require the approval of the lieutenant-governor-in-council of the construction or acquisition of any immoveables and which give Quebec Hydro the right to mortgage its property which it does not need for its ordinary operations if the same body approves.

Other clauses require Quebec Hydro to furnish electricity on a wholesale basis to electric cooperatives under the same conditions as municipalities are sold power, make the commission liable for municipal and school taxes though it is a government body, and confirm the agreement made in December, 1944, by which the commission agreed to pay the City of Montreal during a period of 20 years, an annual sum of $500,000 for municipal and school taxes.

The new measure provides for annulment of the transfer by Montreal Light, Heat & Power of 3,250 preferred shares of the capital stock of the Montreal Coke & Manufacturing Co., and of 510 shares of Keystone Transport, Ltd., and authority is given the Hydro Commission to take possession of such shares by paying to Southmount Investment Co., an amount equal to what was assigned to them at the time of their transfer to such company, which was $631,000.

The government will also secure an interest in a large number of companies in which M. L. H. & P. had holdings.

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WPB Revokes L-123

The War Production Board has revoked Order L-123, which governed production and distribution of 26 items of general industrial equipment, including dynamo-meters, rotary converters, and fractional horsepower electric motors and generators. Production and delivery of these items is allowed subject to other applicable orders and regulations.

Senate Votes Back Cuts in Interior Appropriations

Reclamation Bureau and Power Administrations Fare Well as Upper Chamber Restores $39,000,000 Which House Had Eliminated—Steam Power Plant Planned for San Francisco Bay Area Despite Opposition

The Senate accepted by voice vote this week an amendment authorizing the Interior Department to plan a steam power plant for the San Francisco Bay area and a transmission network for California's Central Valley, both to expand the hydro-electric output of Shasta and Keswick dams.

The amendment was approved after three day's debate in which the amendment was described as opening the way to the needless expenditure by the federal government of $75,000,000 for power properties which the Pacific Gas & Electric Co. had testified it was willing to build.

Rejected by the House when it considered the Interior Department Appropriation Bill for 1946 some weeks ago the amendment, appropriating $215,000 for completion of plans for the steam plant and transmission network, was put into the bill by the Senate Appropriations Committee. It was expected that a vigorous fight over the item will take place when House and Senate conferees meet to adjust interhouse differences in the bill.

Senate Follows Usual Custom

As it normally does, the Senate restored all but the most insignificant cuts in Interior appropriations made by the House. This year, the House chopped more than $41,000,000 from Budget Bureau estimates for Interior's fiscal 1946 appropriation. The Senate restored $39,000,000 of the cut.

The Senate approved an amendment giving the Bonneville Power Administration $3,500,000 for administrative work and some surveys, including surveys necessary to integrate the output of the Hungry Horse Dam, on the south fork of Montana's Flathead River, with BPA's other energy sources, Bonneville and Grand Coulee Dams. In addition, it gave BPA $4,206,690 from unexpended balances for marketing and operation. The House had given BPA no new funds but allowed it about $3,500,000 from its balances.

No change was made in the $110,000 appropriation for the Southwestern Power Administration, which the House had left unchanged also.

Dealing with the Reclamation Bureau, which had suffered the biggest cut in the House, the Senate wrote into the bill an amendment which would have the effect of prohibiting the House ever again from stipulating that Interior should not use any of its funds for a project previously authorized. This the House did in 1943 when it attempted to prevent Interior from building the Shasta-Oroville line, which Interior built anyway.

When it had the 1946 Interior appropriation bill some weeks ago, the committee wrote into its report the statement that Interior should not use any funds to plan or build the Delta steam plan, to firm Shasta output, or a Shasta transmission network. The amendment inserted by the Senate would prohibit the House from making such stipulations effective in the future by providing that funds appropriated for investigation or construction of projects shall remain available for two fiscal years after the fiscal year in which they are appropriated.

Then, going through the numerous Reclamation projects, most of which the House cut by relatively small amounts, the Senate restored every cut.

Debate on the item for planning the steam plant and transmission systems to back up Shasta and Keswick Dams continued through most of one session.

Opponents of the move to give the Reclamation Bureau $215,000 for planning these projects said it was wrong to spend money for plans which would require ultimately the expenditure of $75,000,000 on facilities which would only duplicate those of the Pacific Gas & Electric Co. and which would not bring service to presently unserved areas. They pointed out that the entire area is now served by P.G. & E. and that there is no complaint against the company's rates. In addition, they argued, P. G. & E. has offered to purchase every kilowatt-hour that can be produced at Shasta and Keswick and to furnish the steam back-up necessary to let the two hydro projects really operate on a worthwhile basis.

It was argued that if the planning funds are made available this year Reclamation will be back next year looking for construction funds.

Those who insisted on giving Reclamation the planning funds argued that the Government would be giving away a bargaining advantage if Congress refused to let Interior plan the steam plant and transmission lines. P. G. & E. then could set its own price for Shasta output, since the Government would have no other customer. It was argued, in addition, that failure to allow the planning item would be to confirm P. G. & E. "forever" in the "monopoly" it now enjoys.

Earlier, Sen. John Overton, Louisiana Democrat and chairman of two subcommittees to study the Murray Bill, establishing a Missouri Valley Authority, wrote the epitaph for MVA legislation in 1945 when he announced that hearings by the irrigation and reclamation subcommittee, of which he is chairman, would not be held until September 17. Overton was chairman of the commerce subcommittee which recently brought out a blistering adverse report on the Murray Bill. After hearings before the irrigation and reclamation subcommittee, the bill will go to the Agriculture Committee.

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Paper Is Ammunition

Paper is scarce today because over 700,000 different war items are wrapped, labeled or made from paper or container board. The war in the Pacific increases the demand because products going to that area require double and triple packing for protection against weather and insects.

So share your ELECTRICAL WORLD; the number of copies is limited.

Keep in operation in your office and plant a continuous drive to collect all waste paper for salvage. Contribute your dead correspondence, obsolete records, useless display material, and unusable cartons.

Saskatchewan Sells All Plants Outside of Province

The power properties of the Dominion Electric Power Co. which were acquired early this year by the government of Saskatchewan are now all located in the province as the result of the recent sale of seven power plants, four in Alberta, two in British Columbia, and one in Manitoba.

Walter Schlosser, Estevan, former director and present general manager of the utility company which is still being operated by the government apart from its provincial power commission system, and a group of associates paid $251,059 for the seven plants. There was no other bid for the properties.

Men Under 30 Likely to Be Drafted under New Rules

New inroads by Selective Service on the few remaining deferred male workers under 30 years of age are in prospect under the latest draft policy, which in general will halt inductions of men over 30.

In a memorandum to local boards outlining its position, National Selective Service declared that:

"Cutbacks in plants engaged in war production should make available for employment older workers or those disqualified for military service. These workers, together with the increasing numbers of veterans who will be released by the Armed Forces, will make it possible for employers to replace many registrants in the younger age group who have heretofore necessarily been deferred."

National Selective Service pointed out that, in most cases, deferments were granted to allow the training of replacements, and added that employers have now had four years in which to do so.

In outlining the new policy, Selective Service directed local boards to call up for re-examination physically deferred and limited service men between 18 and 25. Men 30 or over are eligible for deferment if they are regularly engaged in useful work.

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B. C. Power Commission Appointed by Premier

A three-man board has been appointed by Premier Hart of British Columbia to administer the British Columbia Power Commission for rural electrification. Chairman of the board will be Samuel R. Weston, former chief engineer of the British Columbia Public Utilities Commission and a member of the Engineering Institute of Canada.

The two other members appointed are Major General W. W. Foster who will relinquish his post as special commissioner for defense projects in northwest Canada, and Forest L. Shaw, city solicitor for Victoria.

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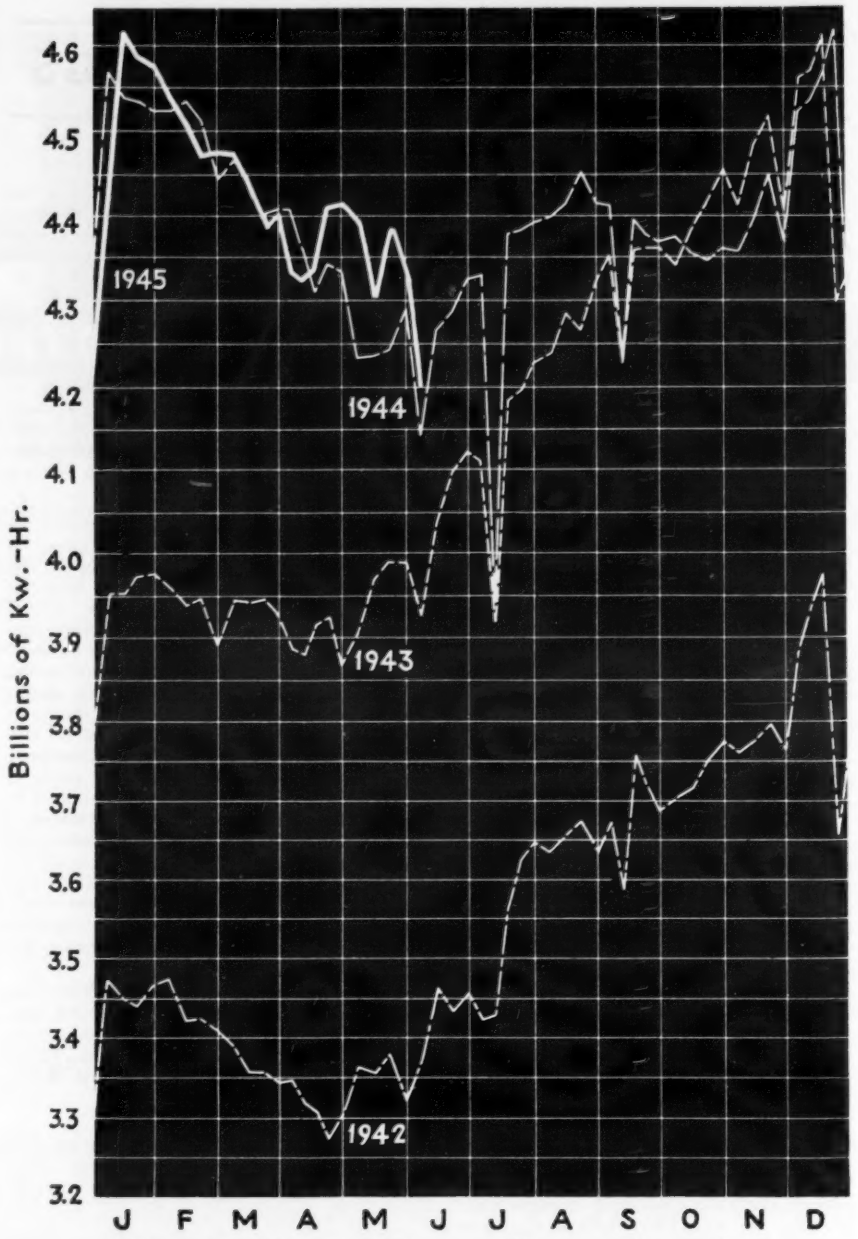
Santee-Cooper Will Move Offices to Moncks Corner

Santee-Cooper Authority hydroelectric project of South Carolina, will move its offices from Columbia to Moncks Corner by June 15 to be near the project's actual physical properties, General Manager R. M. Jefferies has announced. Jefferies and R. Lane, an executive employee, will maintain part-time offices in Columbia.



Electric Output Curve Drops Sharply

The electric output curve moved downward during the week ended June 2, 1945, which contained the Memorial Day Holiday, according to figures released by the Edison Electric Institute. The amount of electrical energy distributed by the light and power industry totaled 4,203,502,000 kw., compared with 4,329,605,000 kw.-hr. during the preceding week. During the week ended June 3, 1944, the amount of electrical energy distributed amounted to 4,144,490,000 kw.-hr., this year's figure representing an increase of 1.4 percent.

Five of the seven major geographical regions of the country reported increases as compared with last year, only the Rocky Mountain and the Pacific Coast groups being in the minus column, with decreases of 0.1 and 3.3 percent respectively.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
June 2	4,204	June 3	4,144	June 5	3,926
May 26	4,330	May 27	4,292	May 29	3,990
May 19	4,377	May 20	4,246	May 22	3,992
May 12	4,302	May 13	4,238	May 15	3,969
May 5	4,397	May 6	4,234	May 8	3,904
Apr. 28	4,416	Apr. 29	4,336	May 1	3,867
Apr. 21	4,411	Apr. 22	4,344	Apr. 24	3,925
Apr. 14	4,332	Apr. 15	4,307	Apr. 17	3,917
Apr. 7	4,322	Apr. 8	4,361	Apr. 10	3,882
Mar. 31	4,329	Apr. 1	4,409	Apr. 3	3,890
Mar. 24	4,402	Mar. 25	4,409	Mar. 27	3,928
Mar. 17	4,398	Mar. 18	4,400	Mar. 20	3,947

Percent Change From Previous Year

	Week Ending		
	June 2	May 26	May 19
New England	+ 2.2	+ 0.5	+ 3.8
Mid Atlantic	0.0	− 3.2	− 1.3
Central Industrial	+ 2.7	+ 2.2	+ 4.7
West Central	+ 3.9	+ 2.6	+ 6.8
Southern States	+ 6.8	+ 6.7	+ 8.2
Rocky Mountain	− 0.1	+ 0.0	+ 6.1
Pacific Coast	− 3.3	− 0.9	+ 0.3
Total United States	+ 1.4	+ 0.9	− 3.1

SEC DECISIONS—HEARINGS

The Securities and Exchnage Commission, in a series of orders recently issued affecting electric utility companies:

HAS ORDERED American Light & Traction Co. and its parent, United Light & Railways Co., to comply within thirty days with the terms of its order for integration issued in 1941, failing which the commission would seek court enforcement of its own plan for compliance. The commission considers the liquidation and dissolution of American Light to be the "most appropriate means" for complying with the integration order, which calls for the divestment by American Light and its parent of their interests in Detroit Edison Co., Michigan Consolidated Gas Co., Madison Gas & Electric Co. and Milwaukee Gas Light Co.

HAS APPROVED the amended recapitalization plan filed by Commonwealth & Southern Corp. The commission unanimously held that the plan met the requirements of its one-stock recapitalization order of April 9, 1942, and "was fair and equitable to the security holders of the company." The commission also approved the plan as "an appropriate step toward bringing Commonwealth into compliance with the integration standards of the Act." The commission withheld its formal order of approval, pending the filing of certain minor adjustments, and gave the company 15 days to file the suggested amendments, following which the plan will be submitted to a vote of the stockholders at a special meeting. The plan provides for a distribution of common stocks of four subsidiaries, and of shares of Commonwealth's own new common stock in exchange for the outstanding preferred and common stocks of Commonwealth on the basis of 85 percent for the present preferred stock as a class and the remaining 15 percent for the present common stock as a class. The subsidiaries to be distributed are: Consumers Power Co. (Mich.) Central Illinois Light Co., Southern Indiana Gas & Electric Co. and Ohio Edison Co. Pennsylvania Power Co. became a subsidiary of Ohio Edison following certain readjustments completed a few months ago. Thus all of the existing preferred stock of Commonwealth would be eliminated and the company would be left with five utility subsidiaries operating in Georgia, Mississippi, Florida, Alabama and South Carolina.

HAS EXTENDED for a two-month period ending on August 1, the time in which Associated Electric Co. and its subsidiary, Missouri General Utilities Co., may consummate commission-approved transactions. The latter include Associated's proposal to sell its entire interest in Missouri and to acquire certain assets of Missouri.

RELEASED JURISDICTION over the payment of legal fees and expenses in connection with the recapitalization plan of Georgia Power & Light Co. and the issuance and sale by Florida Power Corp. of 40,000 shares of preferred stock with an aggregate par value of $4,000,000.

HAS RULED that Inland Power & Light Corp. has ceased to be a holding company. Trustee of Inland notified the commission that Inland has delivered to the Middle West Corp. 39,278 common shares of the Arkansas-Missouri Power Corp. and 2,400 common shares of the Missouri Edison Co. pursuant to an approved plan for the reorganization of Inland. He added that Inland also had disposed of all voting securities of public utility companies formerly held by it.

APPROVED DIVIDEND declaration by the North American Co., payable on July 2 to holders of $25 par value common stock in its subsidiary, Pacific Gas & Electric Co., of record of June 1. One share of Pacific stock will be given for each 100 shares of North American. Holders of fewer than 100 shares of North American will receive 38 cents a share.

Applications Filed

ROCHESTER GAS & ELECTRIC CORP. has filed a proposal to "strengthen its financial structure" through reclassification of the company's outstanding preferred stock and retirement of 40,000 shares. If the commission approves the plan, the outstanding preferred stock, consisting of 120,000 shares of 6 percent series D and 40,000 shares of 5 percent Series E would be reclassified into 4 percent series F preferred. The company would redeem at $105 a share the stock of any preferred stockholder who objected to the reclassification and, after obtaining a two-third vote of the common and preferred stockholders, would redeem as much as 40,000 shares of the stock at $105. Upon completion of the proposed program Rochester Gas would have 120,000 outstanding shares of preferred with an aggregate par value of $12,000,000.

CENTRAL NEW YORK POWER CORP. has filed a post-effective amendment to its commission-approved proposal to purchase in the open market a total of $3,792,000 principal amount of its non-callable bonds.

Hearings Scheduled

JUNE 15: On Consolidated Gas & Electric Co.'s plan to simplify the corporate structure of its wholly owned subsidiary, Islands' Gas & Electric Co.

JUNE 18: On application of the Ogden Corp. for a limited exemption from the terms of Rule U-45 of the Holding Company Act.

JULY 17: Reconvened hearing on Columbia Gas & Electric Co.'s plan for divestiture of properties and corporate simplification to comply with Public Utilities Holding Company Act. The Columbia company requested postponement on the ground that it and the United Corp., which owns 19 percent of Columbia's common stock and opposes the Columbia plan, are seeking "a program upon which Columbia and United could agree."

UTILITY REPORTS

	Net Income 1945	1944
*American Gas & Electric and subs.	$10,630,503	$10,015,873
†Birmingham Electric	1,667,176	1,215,591
*California Elec. Power and subs.	1,256,539	1,295,135
†Central Arizona Light & Power	762,747	868,163
†Commonwealth & Southern and subs	11,789,382	11,905,135
*Dayton Power & Light	1,555,251	1,541,455
*General Gas & Electric and subs.	1,741,502	1,723,930
†Houston Lighting & Power	3,114,205	2,872,611
*New Jersey Power & Light	1,396,339	1,224,218
*Oklahoma Gas & Electric	2,411,304	2,628,311
†Utah Power & Light and sub.	1,823,423	2,322,192

*Twelve months ended March 31.
†Twelve months ended April 30.

Central Illinois Utility Gets Approval for Power Plant

Approval for immediate construction of Meredosia power station and installation of the first 50,000-kw. turbine together with a 138-kv. transmission line to interconnect this new station with Hutsonville generating station on the Wabash River has been given the Central Illinois Public Service Co., Springfield, by the War Production Board, according to an announcement by Vice-President E. F. Kelly.

This approval will permit C.I.P.S. to proceed immediately with contracts and start construction estimated to cost $10,000,000. Present plans call for this first 50,000-kw. unit to be in operation by the summer of 1947. The company expects to install a second unit of the same size to be ready in 1949. In addition to this first unit, approval also covers the building of 163 miles of 138,000 volt transmission line between Meredosia and Hutsonville stations, together with a large transformer and switching station at Pana, Ill. Construction of the transmission line will begin immediately.

The Meredosia station will be constructed on the site along the east bank of the Illinois River and just south of Meredosia, Ill. purchased by C.I.P.S. in 1940.

This construction was started in 1941, Mr. Kelly explained, but was stopped by WPB in August, 1942. At that time WPB indicated the turbo-generator and its related equipment would be taken over by the government for shipment to Russia, and the company was later advised that this had been done.

Utility Sues Indianapolis for Old Street Lighting Bill

To collect a bill for street lighting which it claims is five years past due, the Indianapolis Power & Light Co. has brought suit in Superior Court against the city of Indianapolis.

The complaint declares the utility sent to the city a bill of $8,791.32 for street lighting from October 10 to December 31, 1939. Early in 1940, a partial payment of $2,438.46 was made. The suit demands the remainder plus interest and attorney fees.

HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

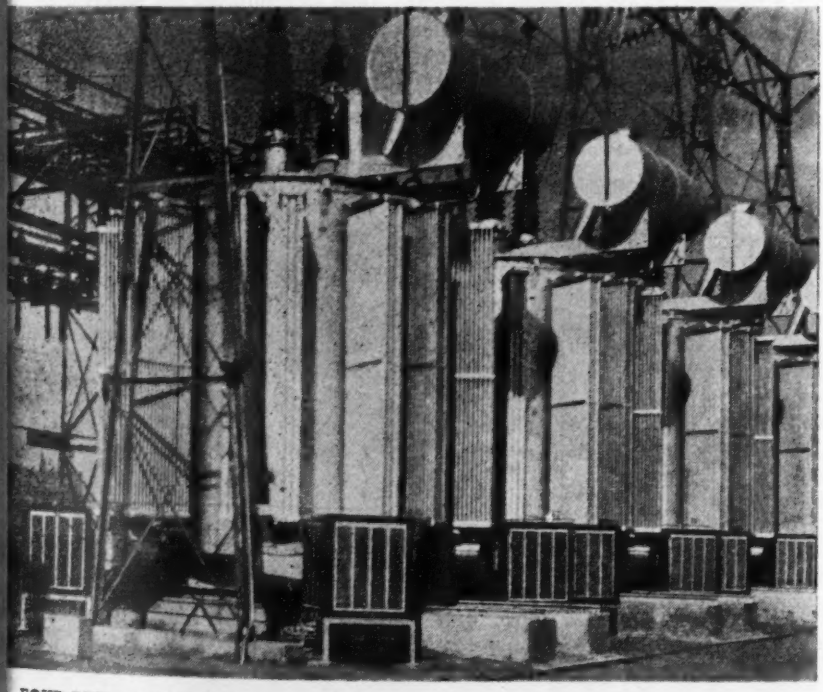
Desert Coolers Solve Cooling Problem on Three-Winding Transformers

By E. W. OTTO,

Designing Engineer, San Joaquin Division, Pacific Gas & Electric Co., Fresno, Calif.

To solve a transformer cooling problem at one of its oil field substations in the lower end of the San Joaquin Valley, Pacific Gas & Electric Co. has made an installation of so-called desert coolers as shown. The problem was to provide additional capacity at 12 kv. to meet increased load. Transformers were of 10,000-kva. capacity with three windings, an 110,000-volt Y/72,760-volt Y-autotransformer winding, a 7,580/13,110-volt Y-winding to serve the distribution system, and an 11,000-volt tertiary winding. The problem was further complicated by the fact that in order for the neutral end of the autotransformer winding to carry the load desired an average oil temperature of 55 deg. C., or a peak oil temperature of 65 deg. C., was the very maximum permissible.

The first step was to split the tertiary winding into a 7,340/12,710-volt Y-winding connected independently to a heavy distribution circuit, and a 3,670-volt tertiary winding. This increased the usable 12-kv. capacity for the distribution system from 5,000 kva. to 8,333 kva. per transformer, at the same time reducing full transformer losses from 97 kw. to 95 kw.



FOUR DESERT COOLERS per 10,000-kva. transformer reduced temperature 6 deg. C. on a 104-deg. F. ambient day as compared with straight forced air cooling

To obtain the low oil temperatures desired it was decided to use evaporative-type, forced air cooling equipment. This was provided for three of the main transformers (none for the spare) as follows: Four manually controlled evaporative coolers rated at 4,000-cfm. capacity each were installed per transformer, along with the necessary air duct to distribute the air properly to the transformer radiators. The cool air was brought up between pairs of radiators, as near the bottom as possible. The existing arrangement of eight pairs of radiators, all radial to the tanks, was ideal for this. It was found necessary to install deflectors in the air duct discharges to distribute the air to best advantage. Water supply and return piping was installed for the system. The water is re-circulated for all coolers in the bank by a 20-gpm. pump, so that the only make-up required is that for water lost by evaporation, which totals about 3 gpm. maximum.

Test for Effectiveness

A test was run to determine effectiveness of the cooling system. Evaporative cooling was used on one transformer, forced air only on another and self-cooling on the third. With an ambient temperature of 104 deg. F. and total losses of 73.1 kw., the three transformers showed temperatures respectively of 52 deg. C., 58 deg. C., and 62 deg. C., indicating that expectations had been met.

Although first cost of the desert coolers was considerably less than for forced air cooling, operating cost is slightly higher. However, as previously stated, these transformers pre-

sented a particular problem in that the neutral end of the high-voltage winding made it imperative to keep oil temperatures lower than is ordinarily required when overloading. In a straight two-winding transformer or on smaller transformers, straight forced air cooling might have been preferable because of its simplicity, event though first cost would have been higher.

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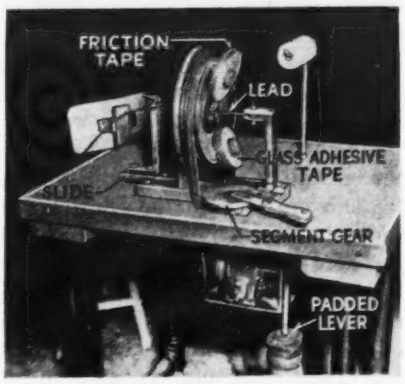
Leads of Various Lengths Taped by Machine

By C. T. PACKER

Manufacturing Engineer
Westinghouse Electric Corp.
Lima, Ohio

A machine has been developed to wind in one operation both adhesive glass tape and friction tape on various



TAPE MOUNTED on belt-driven wheel is wound on leads of various lengths

lengths of leads. It is shown in the accompanying illustration and is in operation in a Westinghouse plant. In the past where friction or other adhesive tapes were wound on leads the operations were done by hand because no machine was available which would handle these kinds of tapes.

The two rolls of tape are mounted 180 deg. apart on a wheel which revolves at approximately 100 rpm. This wheel is V-belt driven by a motor through a speed reduction unit mounted under the table. The motor runs continuously; the drive, being mounted on a movable base, is actuated by a belt tightener device that is operated by a padded lever under the table. The padded lever when pressed outward by operator's knee puts pressure on the slack side of the V-belt.

The operator clamps the lead in position between the two uprights on the slide and through the hole in the hub of the wheel on which the two rolls of tape are mounted. The under layer of glass adhesive tape is started one turn ahead of the friction tape which is the top layer.

As the hand-operated segment gear is turned, it moves the slide and wire to the left. The amount of overlap is controlled by the speed at which the slide is moved.

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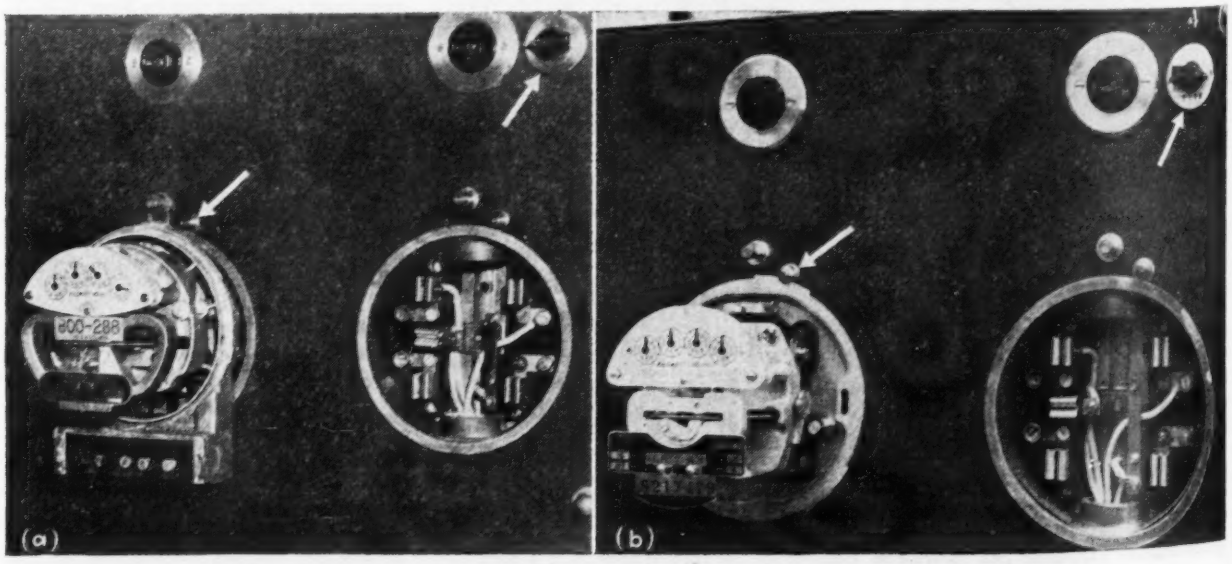
Test Board Mounts for "A" and "S" Type Meters

Standard meter sockets provide a convenient method for mounting meters on a test board. On a gang test board of the Boston Edison Co. the sockets are equipped with five regular terminals and a spring type potential finger, so that both single-phase and three-phase socket meters may be tested. The spring type potential finger serves as a potential terminal for three-wire socket meters. The potential connections to the socket terminals have been made inside the socket, while current connections have been made by means of special adapters through the base of the socket.

A locking device has been designed to hold the meters in place. When socket type meters are to be tested, the locking switch is set at the "S" type position (Fig a). This causes a small button-shaped piece of metal with a beveled surface to protrude just beyond the rim of the socket. When the meter is pressed into the socket, the piece of metal hooks over the metal base and holds it firmly in position. When the meter is to be removed the metal piece is pushed up thus freeing the meter base.

If bottom connected meters are to be tested (Fig. b) the locking switch is turned to the "A" position and this causes the button-shaped metal piece to be pulled snug against the panel. In this position it offers no obstruction to hanging the meter. With this type of mounting the socket does not set up flush with the ebony asbestos panel, and thus "A" type meters, when hung over the socket, cannot scar the panel.



USE OF STANDARD METER SOCKETS (a) on test board; (b) Mounting of bottom-connected meter on test board

Two-Way Talk with Linemen

By W. L. CAMPBELL

Communication Engineer, Northwestern Electric Co., Portland, Oregon

Speed and ease of directing line work is provided by a combination loud speaker and microphone mounted on the car of line superintendent D. L. Hiatt of Northwestern Electric Co., Portland, Ore. The two-way feature is accomplished by installing the necessary switches as illustrated. These switches make possible the following operations of the equipment:

1. With a portable microphone and the audio system in the car radio acting as a speech amplifier, the operator can talk through the fender-mounted loudspeaker to issue orders.

2. With the fender-mounted loudspeaker acting as microphone, the audio system in the car radio and the loudspeaker in the car set are used to pick up and reproduce sound entering the outside speaker-microphone.

3. Normal operation of the car radio for receiving signals from the dispatcher.

4. Outside speaker may be paralleled with car set speaker to permit hearing signals from the dispatcher at some distance from the car.

OPERATOR uses portable microphone to give orders through fender-mounted loud speaker. Speaker acts also as microphone to return voice of workmen at some distance from car

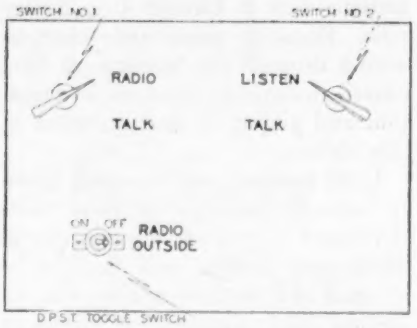


FIG. 1—With switch 1 "up" in the normal position, the car receiver is left clear for calls from the load dispatcher and the microphone clear for ordinary transmitter use. With both switches 1 and 2 in the "down" position, the "mike" feeds the outside speaker through the car receiver audio amplifier. By changing switch 2 to the "up" position, the outside speaker acts as a microphone feeding the receiver amplifier to the car set speaker and permits operator to hear men at some distance answering back

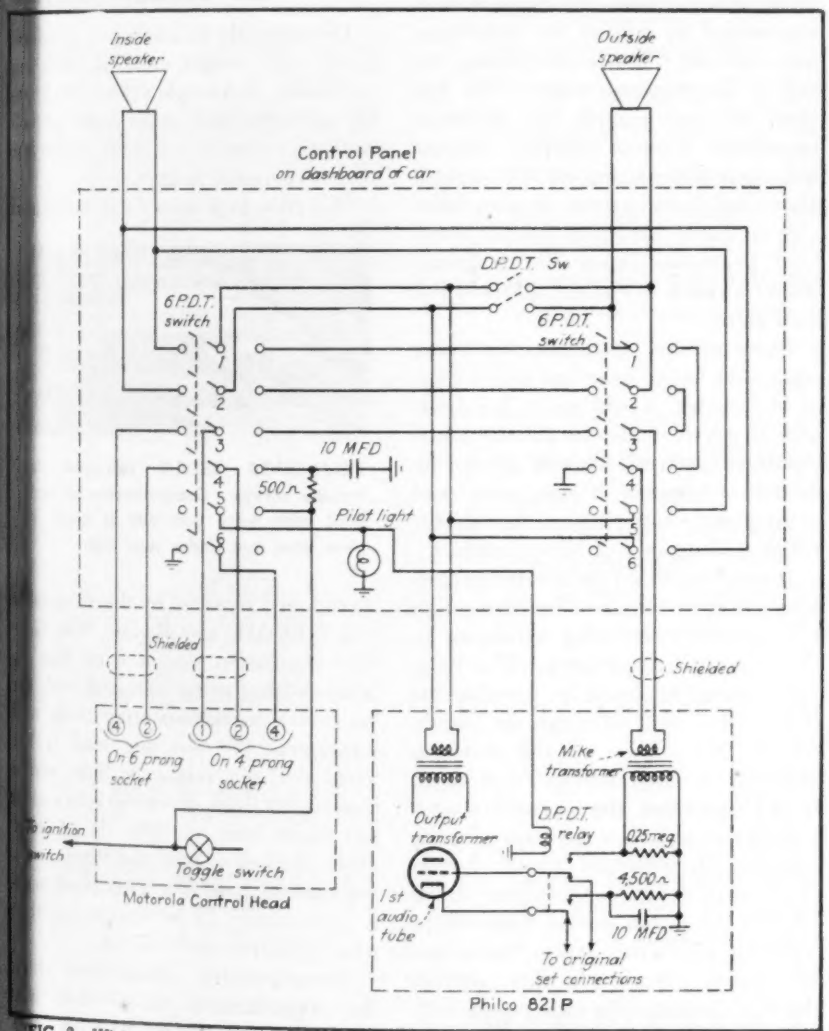


FIG. 2—Wiring diagram for switches for modifying car radio receiver to permit use of fender-mounted loudspeaker as microphone for two-way public address system

To provide power for operation of radio, headlights, spotlight, car heater and other accessories, it was necessary to provide an auxiliary gas engine-driven generator to supplement the regular car generator. This consists of a 150-watt Delco gasoline-driven generator mounted under the hood with controls on the dashboard. This unit charges at the rate of 18 amp. and during the daytime is ample for car heater, transmitter and receiver. For nighttime use when all accessories and lights are in operation and drawing about 30 amp., the Delco unit and the car generator carry the load and in addition furnish substantial charging current to the battery if required.

With the system described, a two-way public address system has been provided with a one-way car with receiver only as two watts of audio with a 15-watt permanent magnet speaker that can be heard clearly more than two blocks away.

Brush Drains Static from Fan Impeller

Ordinary commutator brushes, bearing on fan shafts and grounded to the machine frames, are being used effectively to drain static charges from the impellers of coal exhauster fans at the Ohio River station of Southern

Indiana Gas & Electric Co., Evansville. Formerly these static charges, arcing through the bearing oil film, caused abnormally rapid oil deterioration and pitting of bearing metal at this station.

Until brushes were installed, freshly serviced bearings on these units developed a grainy appearance in about two months and had to be scraped and cleaned again. The oil became dark, showing the effects of carbonization, and had to be changed frequently.

The cause of these bearing troubles was discovered, in the course of routine inspection during normal operation, when a static spark was seen to pass through the bearing oil film at one end of the shaft between the shaft and bearing of the driving motor. Reasoning that such discharges, if frequent enough, could cause the trouble a single grounded brush was installed on each fan shaft, immediately outside the housing, to drain the static charges to ground continuously.

This scheme has been used at Ohio River station for about five years, according to Noel Baun, chief plant electrician. Since its adoption the trouble has been completely eliminated and bearing and oil maintenance has returned to normal.

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Aerial Arrester Used on Underground Cable

Use of a standard arrester to drain off lightning discharges that may enter rural, underground, concentric cable is a practice of the distribution department of the Philadelphia Electric Co. to protect the cable from damage. The arrester mounted on one wall of a creosoted wooden box which is filled with pothead compound has its leads protruding, as shown in the illustration.

Photo by R. M. Hoot

STANDARD 3-kv. aerial arrester in 9-in. by 9-in. by 15-in. wooden box

The boxed arrester is connected to the conductor at a point 75 ft. from the terminal pole. The neutral leg is connected to a driven ground and the cable sheath.

The purpose of the box is to prevent injury to the arrester while being buried; the purpose of the compound is to prevent the penetration of moisture while it is buried.

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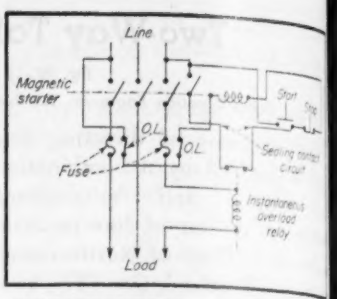
Relay in Sealing Circuit Protects Stalled Motor

By W. C. NODDINGS,
Master Mechanic, Raritan Copper Works, Perth Amboy, N. J.

Protection of an a.c. motor, which was driving a circular saw whose teeth occasionally break and cause a stall, was solved by cutting an instantaneous overload relay in the sealing circuit of the magnetic starter. The line fuses did not provide the necessary protection because starting current indicated fuse ratings of 300 percent above full load current. It was desirable to have the instantaneous overload protection open the magnetic starter as soon as current attained full load value.

However, an instantaneous relay connected in the overload trip circuit of the starter, would make it impossible to get the motor on the line when starting from rest. This is due to the continual hopping of the relay and consequent chattering of the starter while moving in and out of contact.

It was found that the desired protection could be obtained by connecting the instantaneous relay as shown in the accompanying sketch. The magnetic starter is closed by pressing the start button and, although the instantaneous relay hops up and stays up until the starting current dies down to full load value, the magnetic starter will stay closed. It is necessary for the operator to hold the starter button down until the starting current drops off and the instantaneous relay drops back since it is this action that closes the sealing circuit. In this position the relay protects the motor since currents above full load value cause the relay to operate, opening the sealing



INSTANTANEOUS overload relay in sealing contact circuit opens magnetic starter to prevent damage to stalled motor, is shorted on motor starting

circuit which in turns opens the magnetic starter.

The motor ordinarily would not be started unless free from any load that might cause a jammed condition and therefore instantaneous tripout is not provided during this operation.

•

Find Sedan Too Light for Trouble Service

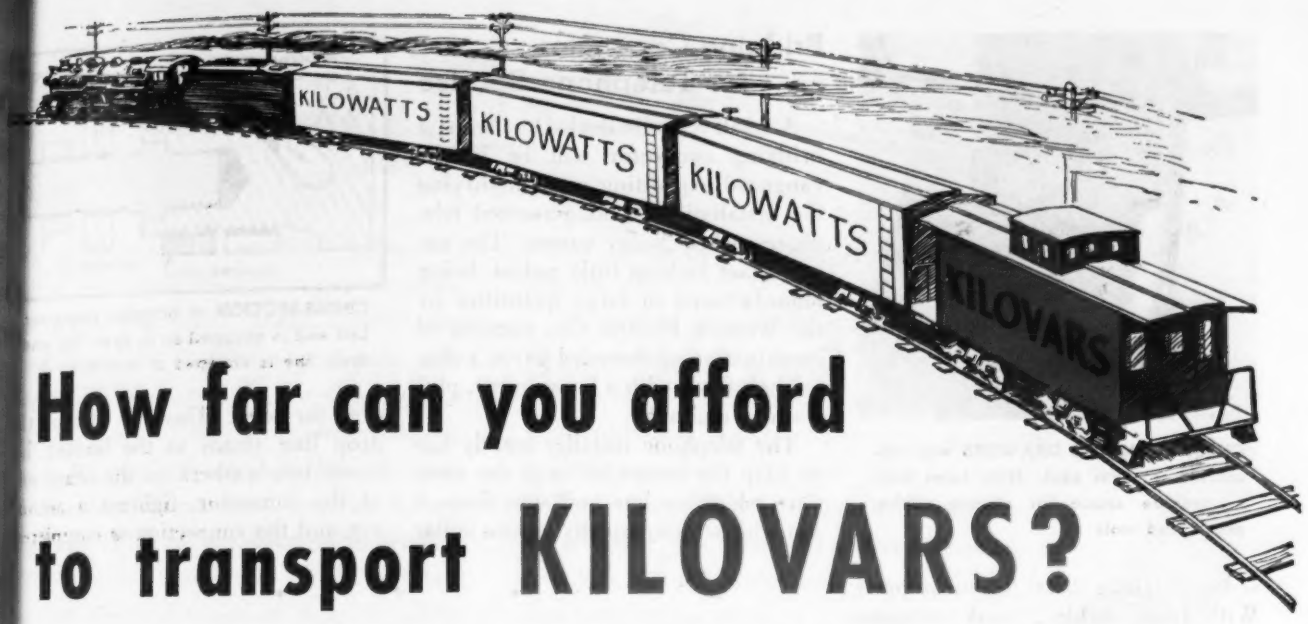
Occasionally in seeking to combine speed, light weight, comfort, visibility and utility in a single vehicle for trouble shooters and street light patrolmen experiments are made in the use of conventional sedans.

One such experiment was made and

FOUR-DOOR SEDAN equipped for trouble service. Compartments for tools and wire were provided in trunk, rear seat and under rear floor

abandoned recently by the Wisconsin Gas & Electric Co., Racine, Wis. General conclusion drawn from this attempt is that when equipped with the necessary trouble-shooting tools and equipment the resulting load is too great for the relatively light sedan chassis. To think otherwise is to expect too much from too little. It was concluded, finally, that the ideal truck for this purpose is a ½-ton truck with a utility body 75 in. long, consisting of a platform and side boxes.

Accompanying illustrations show the experimental sedan that was used as a trouble car on this system. It was a standard four-door



How far can you afford to transport KILOVARS?

Seldom as far as you carry the kilowatts

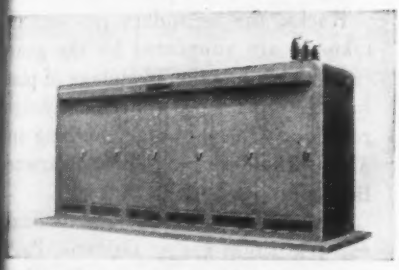
Here's why: The distance that *kilowatts* can be transmitted *economically* to remote loads has changed but little in the last few years, but a great reduction has taken place in the economic transmission distance for *kilovars*.

This reduction is a result of the greatly reduced cost of supplying kilovars near the load area by means of capacitors.

If it cost nothing to supply your kilovar requirements *at the load*, it would be uneconomical to transmit kilovars even as far as your first transformer, because of the system investment that is eaten up in transmitting them. The transmission of kilovars a great distance usually means larger transformers, copper, and other circuit elements. Then, too, the traveling kilovars cause I^2R losses, which drain off companion kilowatts before they reach the payload, as well as I^2X losses.

Naturally, even with capacitors, it still costs something to supply kilovars at the load. But the cost of "on-the-spot generation of kilovars" with capacitors has been reduced during the past 15 years to about one-quarter of the original figure. Hence, a general answer to the question "How far can you afford to transport kilovars?" is this: "Only one-quarter as far as you did 15 years ago." Consideration of this fact may help you meet the ever-present challenge to produce lower-cost power.

We will be glad to help you analyze your kilovar requirements and estimate the benefits of Pyranol capacitor banks on your system. Ask for Publication GEA-4225. *General Electric Company, Schenectady 5, N. Y.*



Attractively styled Pyranol capacitor equipments with or without switchgear are now available for supplying your bulk kilovar requirements. Large outdoor banks can be made up easily out of a number of equipments similar to the 2520-kva equipment shown (houses 168 separate 15-kva capacitor units).

PYRANOL CAPACITORS

Buy all the BONDS you can—and keep all you buy

GENERAL ELECTRIC

407-87-5700

CHEST OF METAL DRAWERS was substituted for rear seat. Note false floor to provide space for storing rubber goods and tools

sedan weighing 2,700 lb. unequipped. With tools, ladder, trunk compartments, chest of metal drawers in place of a back seat and compartment under the rear floor, the car weighed 3,960 lb. Of this 1,260 lb. of equipment about 80 percent was placed on the rear springs.

Although the men using the car were well pleased with the layout and equipment provided, several weaknesses immediately developed. Coil springs in the rear were not strong enough to support the extra weight and failed. These were replaced with heavier springs which, although improving the situation, did not correct it. Tires on the sedan were too small for the load but the use of larger sizes was restricted by clearance inside the fenders. The body and chassis was obviously too light for this duty as certain tie rod members failed repeatedly. The engine too did not seem to stand up as well as sedan engines in normal service. It required frequent maintenance.

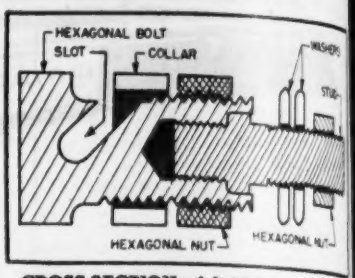
Finally, from a utility operating standpoint, one of the serious weaknesses of the car was the inability to use it to transport even one light transformer in an emergency. Due to the absence of any load-carrying margin for such occasions, functions that a trouble crew could perform with the car in times of emergency were limited.

As a result of these findings this car was stripped of its equipment and is now used for calls and inspections by the engineering department. In this service, which corresponds to that for which the car was normally intended, it has performed very satisfactorily.

Bridging Connector for Telephone Service

A small metallic device known as a bridging connector will be in the vanguard expediting and simplifying the installation of long-awaited telephones when V-day comes. The unimportant looking little gadget, being manufactured in large quantities by the Western Electric Co., consists of combination of threaded parts, a slotted bolt fitted with a brass insert, plus washers and nuts.

The telephone installer merely has to snap the connector onto the open wire telephone line and spin down a nut which automatically locks a collar over the wire. Then, he clamps the drop line (leads to the house) between two washers on the other end of the connector, tightens a second nut and the connection is completed.



CROSS-SECTION of bridging connector. Left end is snapped on to open line and drop line is clamped at washers

• • •

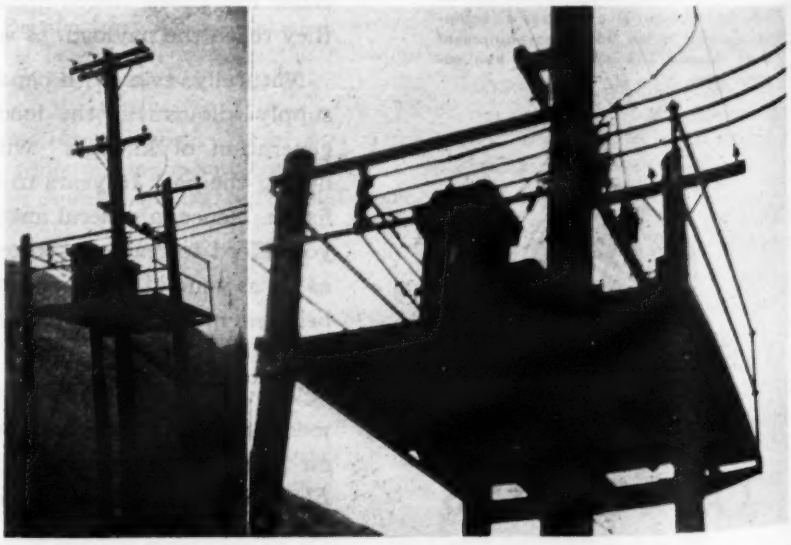
Transformer Installation Has Four Features

Four features of the illustrated transformer installation are its symmetry, the catwalk completely around the transformer, convenient placement of the cutouts and the manner of supporting the secondary racks. Symmetry is obtained by installing a second four-pin arm 5 ft. below the conventionally positioned primary arm and stringing the primary bus between it and the other corner pole; by mounting the cutouts on a 10-ft. arm directly in front of the transformer primary bushing and by using poles with butts of equal diameter.

Approximately 2 ft. remain as a catwalk on all four sides of the three 37½-kva. transformers to facilitate getting from primary to secondary sides. The lineman can easily reach the cutouts which are placed at eye level.

Racks, the secondary bus and the take-off are supported by the guard rails. This has the advantage of placing the bus at a convenient height relative to the secondary bushing and also provides for an unobstructed take-off.

This installation of the Gallitzin Electric Light Co. at Gallitzin, Pa. is large enough to accommodate three 75-kva. transformers.



INSTALLATION of three 37½-kva. transformers (2,300/220 v.) in which the primary leads drop from the bus 25-amp. cutouts and continue in a straight line to the high voltage bushings. At the right are shown the details of the platform which is 12 ft. above the ground—size 8 by 10 ft., with 2-in. oak car-planking layed over 8-in. I beams. Also, note secondary rack supported by the rails

FIVE YEARS *without* A SERVICE FAILURE

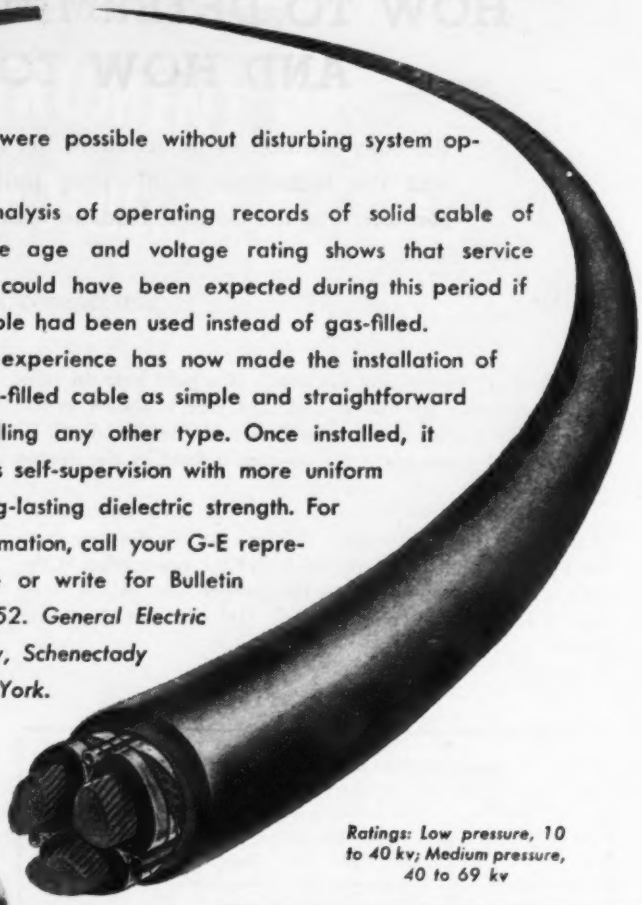
FIVE years ago, G-E gas-filled cable was selected for two important 27-kv feeders under New York's East River. These feeders are among some 20 installations of this self-supervising cable put in by the Consolidated Edison Company of New York, Inc., including several vital ties between generating stations.

"No service failures have occurred in any of the 138,000 feet of gas-filled cable installed on the system," states an A.I.E.E. article.* Wherever sheath damage or leaks in cable joints or terminals have developed, it has been possible to maintain gas pressure and continue operation of the feeder. The location of leaks has been quickly determined by pressure-drop measurements and gas-flow direction indicators. Repairs were possible without disturbing system operation.

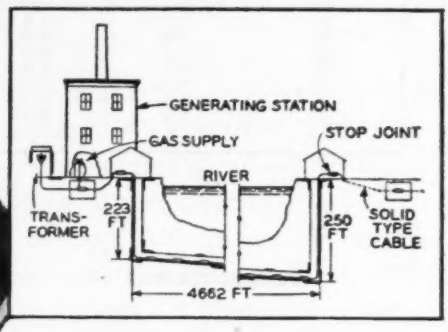
An analysis of operating records of solid cable of the same age and voltage rating shows that service failures could have been expected during this period if solid cable had been used instead of gas-filled.

Field experience has now made the installation of G-E gas-filled cable as simple and straightforward as installing any other type. Once installed, it combines self-supervision with more uniform and long-lasting dielectric strength. For full information, call your G-E representative or write for Bulletin GEA-3652. *General Electric Company, Schenectady 5, New York.*

*—*Operation of Low-pressure Gas-filled Cable*, C. T. Hatcher, *ELECTRICAL ENGINEERING*, Nov., 1944



Ratings: Low pressure, 10 to 40 kv; Medium pressure, 40 to 69 kv



PROFILE NO PROBLEM—The two 3-conductor feeders of 500,000-cm gas-filled cable installed in a tunnel under the East River have vertical risers of 250 and 223 feet at the ends. Yet the installation presented no difficulties that were due to compound migration. A simple nitrogen-gas cylinder connection, equipped with a warning pressure relay, maintains pressure throughout the cable run from the generating station.

BUY ALL THE BONDS YOU CAN—AND KEEP ALL YOU BUY

GENERAL ELECTRIC

GAS-FILLED CABLE

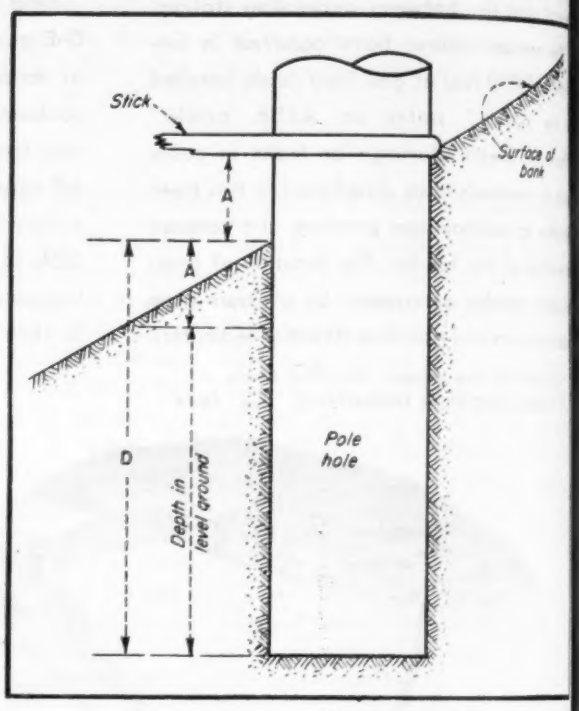
HOW TO DETERMINE POLE-HOLE DEPTH AND HOW TO BLOCK POLES

An easy method of determining the pole-hole depth for side-hill construction and the technique of blocking poles are adapted from the construction standards of the Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y.

DETERMINING POLE-HOLE DEPTH

Method of determining the depth of a pole hole on side-hill construction by use of stick and rule is shown in the sketch. This depth is increased over the setting depth in level ground (see table); the amount is fixed by the degree of the slope.

To determine the increase, place the stick horizontally at the upper edge of the hole and measure the distance (represented by A) between the stick and the lower edge of the hole. This figure added to the proper one in the table results in the correct pole depth (D) for that degree of slope.

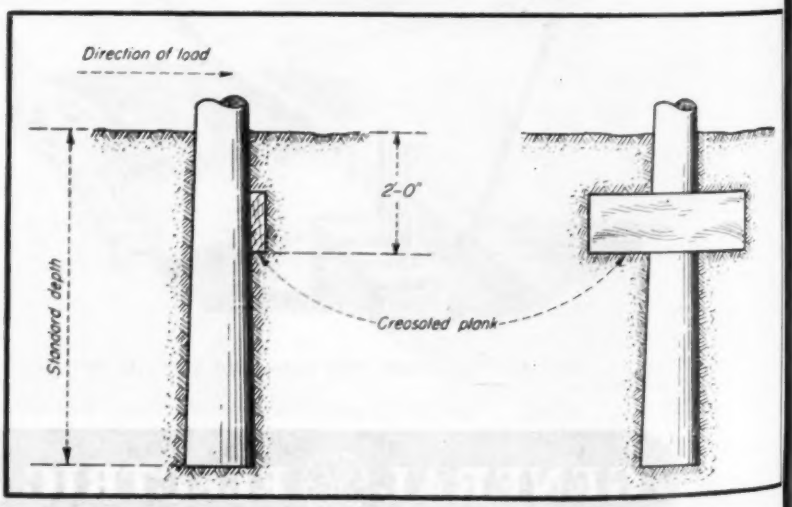


Pole Setting Depths in Level Ground

Length of Pole, (ft.)	Feet in Earth		Feet in Rock
	Yellow Pine	Cedar	Pine & Cedar
25	4.5	...	4.0
30	5.5	5.5	4.5
35	6.0	6.0	5.0
40	6.0	6.0	5.0
45	6.5	6.5	5.5
50	7.0	7.0	5.5
55	7.5	7.5	5.5
60	8.0	8.0	6.0

POLE BLOCKING

Blocking of poles is accomplished by use of a 12 by 4 by 36-in. creosoted plank placed with the lower edge 2 ft. below the ground line on the load side of the pole. The service and straight-of-way pole is set at standard depth as listed in the above table; the angle pole on which the side pull is less than 1,500 lb. is set at standard depth plus 2 ft. (A pole with greater side pull is guyed instead of blocked).



BUYING AN INSTRUMENT TRANSFORMER LIKE THIS...?

TS ACCURACY CLASSIFICATION IS IMPORTANT!

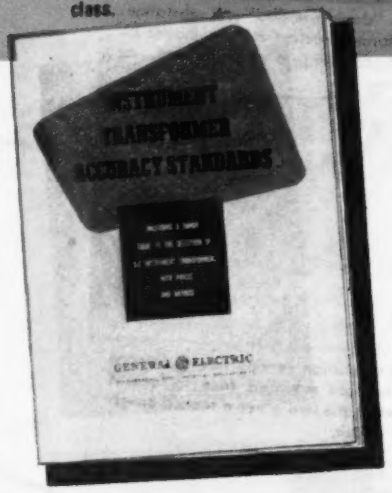
ASA Burden	B-0.1	B-0.2	B-0.5	B-2
ASA Accuracy Class	0.3	0.3	0.3	0.3

This means that, with standard ASA burdens, the ratio correction factor and the transformer correction factor will be within the limits of the ASA accuracy class 0.3.

NEMA Burden	X	Y	Z
NEMA Accuracy Class	¼	¼	¼

This means that, with standard NEMA burdens, the ratio error and the phase-angle will be within the limits of the NEMA ¼ accuracy class.

Type KF-316 current transformer, 34,500 volts, for accurate metering service and relay operation



FOR A BETTER UNDERSTANDING OF ACCURACY CLASSIFICATION

This publication explains the ASA accuracy standards for current and potential transformers and shows how they differ from the NEMA standards. Also, you will find this booklet a handy guide to the selection of G-E instrument transformers. Ask for your copy of GEA-4240 today. Address the G-E office nearest you.

ALL G-E instrument transformers are classified in accordance with the new ASA system, but to get the *right transformer* for your particular need, an understanding of this new system is very helpful.

For example, different applications often require different transformer characteristics. A transformer that is satisfactory for metering purposes (highest accuracy up to 100 per cent of its current rating) may not be satisfactory for relaying purposes where the *overcurrent* characteristics (currents as much as 20 times normal) must be considered.

The ASA system of accuracy classification has made possible the most precise method yet devised for selecting instrument transformers. A thorough knowledge of this system will help you in the selection of transformers with the most suitable characteristics for the job to be done. *General Electric Company, Schenectady 5, N. Y.*

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

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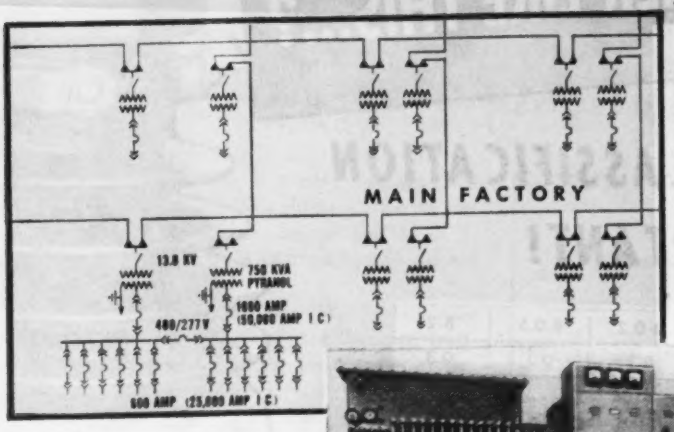
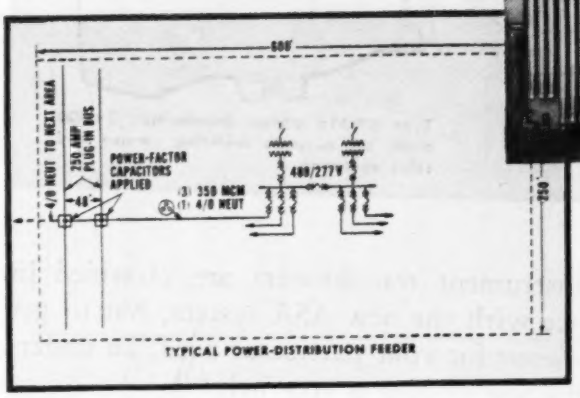
GENERAL ELECTRIC

604-15-6400

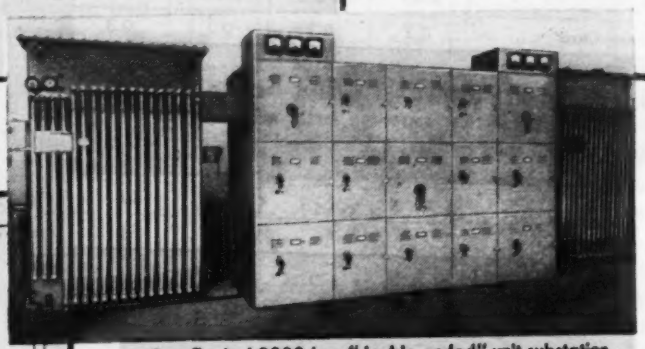
This War-Plant POWER SYSTEM HAS





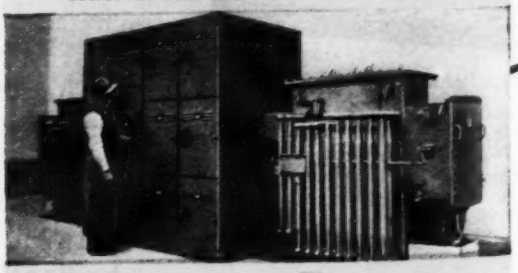
(Upper chart) A section of the "one-line diagram" for the main factory area, where 16 unit substations aggregating 30,000 kva are installed.

(Lower chart) "Close-up" of factory area served by one substation, showing 40-ft spacing of plug-in bus. Note that one substation serves 150,000 sq ft.



1. Typical 2000-kva "double-ended" unit substation. A Pyranol* transformer section permits indoor installation without creating a fire hazard, as Pyranol can't burn.

6. A 5000-kva unit substation serving heavy-demand area, with two sections mounted face to face. A tie breaker between the two gives a second power source for each circuit.



7. One of four 200-kva units serving the office area and basement, conveniently located in "penthouses" above the load centers.

LOAD-CENTER
Power Distribution Systems

*Trade-mark reg. U.S. Pat. Office

L7 Strong Points

Designed to save on materials and manpower, this load-center installation has made an unusual operating record for safe and reliable power distribution.

1 Load-center unit substations are employed throughout in a *secondary selective* arrangement. The two primary feeders to every substation start from different 13.8-kv buses. Every load circuit is backed up by two independent sources of power. Yet all equipment normally shares in carrying total load. All necessary immediate switching to maintain power supply can be done at 480 volts.

2 Primary distribution at 13.8 kv is handled by 3-conductor feeder cables carried in overhead troughs. Overhead installation saved manpower and materials. Inspection and relocation of cables are easy.

3 480 Y/277-volt secondary circuits serve local load-areas by means of plug-in bus. As substations are installed on the building roof, feeder taps to each plug-in bus are short and direct.

4 Fluorescent lighting of factory area is supplied from the same unit substations which serve factory operation. The 277-volt operation of lights from the line-to-neutral conductors of the system is highly economical, as compared with 120- or 208-volt circuits.

5 Capacitors, applied close to the machine-tool motor load, add to the carrying capacity of the substations. They are ceiling-mounted in blocks of 90-kva at the feeder taps of the plug-in bus throughout the main factory area. (10,000 kva, total).

6 Areas of heavy demand, requiring motors of 250 hp and larger, are served by separate substations which convert from 13.8 to 2.4 kv, again using the secoadary-selective principle. Within these areas, small motor and lighting loads are powered by "sub-substations" which have 2.4-kv primary and 480/277-volt secondary.

7 An extensive office-building area is served by unit substations having secondary circuits at 208/120 volts.

POWER SYSTEMS LIKE THIS protect operating continuity and give any plant greater flexibility to meet changing needs. They can be applied to old plants as a complete modernization project, or step by step without interrupting production. The over-all installed cost is fully predictable.

G-E application engineers will be glad to give you recommendations based on highly successful wartime installations. *General Electric Company, Schenectady 5, N. Y.*

Buy all the BONDS you can—and *keep all you buy*

GENERAL ELECTRIC

HOW TO USE SIGN-LIGHTING TRANSFORMERS FOR BOOSTING OR BUCKING THE VOLTAGE OF SINGLE-PHASE CIRCUITS

By C. E. BURKE and H. K. PRITCHARD, Specialty Transformer Section, Fort Wayne (Ind.) Works, General Electric Co.

Table gives information on how standard sign-lighting transformers can be connected as autotransformers to boost or to buck the voltage, and the percentage increase or decrease of voltage and kva. output resulting.

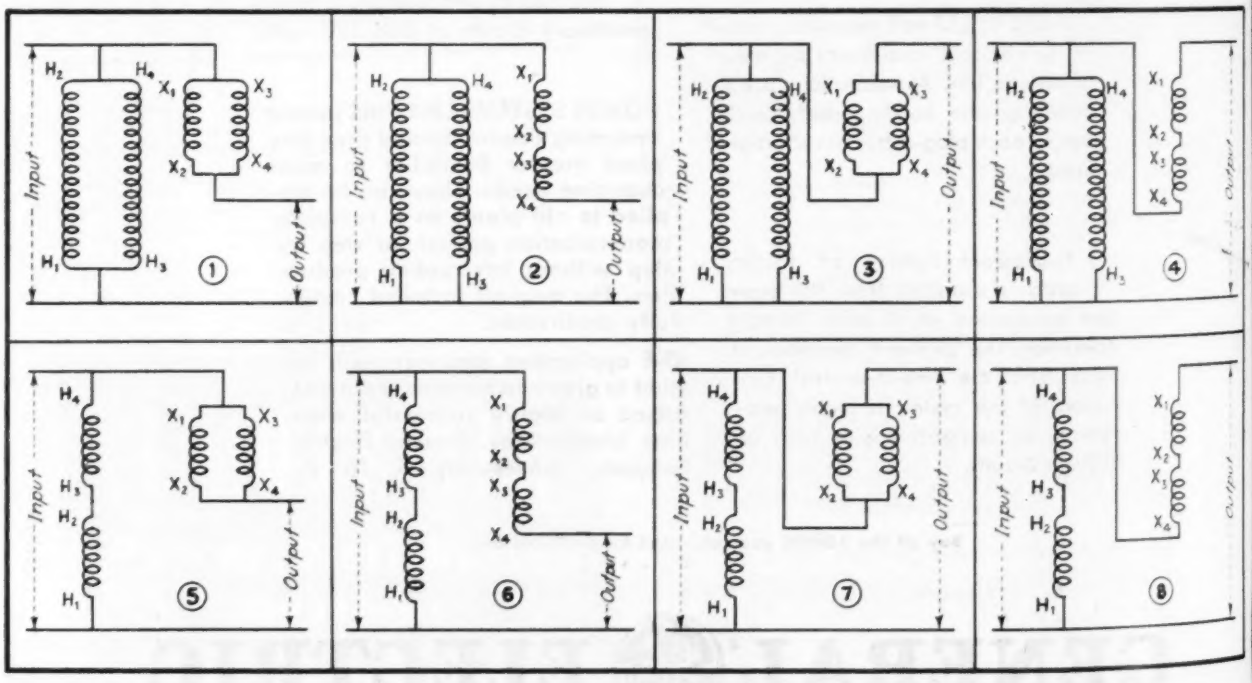
(1) Nominal Circuit Voltage	(2) Transformer Connected to	(3) % Change of Circuit Voltage	(4) Connection Diagram Fig. No.	(5) Kva. Output* in Percent of Nameplate Rating
115	Boost	10	1	1000
	Boost	20	2	500
	Buck	10	3	1000
	Buck	20	4	500
230	Boost	5	5	2000
	Boost	10	6	1000
	Buck	5	7	2000
	Buck	10	8	1000

* Kva output when output voltage equals nominal circuit voltage (Col. 1). When output voltage is different from nominal circuit voltage, multiply percentage values of Col. 5 by ratio of actual output voltage to nominal circuit voltage (Col. 1).

Frequently, it is necessary to increase or decrease the voltage of a single-phase circuit to obtain satisfactory, efficient and safe performance of the electrical apparatus to be served. Many such problems can be solved by using standard, sign-lighting transformers instead of specially designed and constructed transformers, at a saving in first cost and time, with merely a negligible amount of sacrifice brought about by a slightly more difficult, yet quite simple, scheme of connections.

Standard sign-lighting transformers for 60 cycles, high voltage 115/230, low voltage 11.5/23, are available in kva. ratings of 0.25, 0.50, 0.75, 1.0, 1.5, 2.0, 3.0 and 5.0. A 50-cycle line of the same kva. ratings and a 25-cycle line of the first six kva. ratings (through 2 kva.) are also available.

Standard transformers, rated 60 cycles, 115/230 to 32-volts, can be connected similarly as autotransformers to change the voltage of 115-volt nominal and 230-volt nominal circuits by 27.8 percent and 13.9 percent, respectively. The kva. output (Col. 5 of the tabulation) will be 360 percent and 720 percent, respectively, of the nameplate rating.



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Quickly-Easily-Accurately...

WITH THIS HANDY VARNISH SELECTOR

GENERAL ELECTRIC
SULATING VARNISH SELECTOR
How to Use Selector
1 Under RECOMMENDED APPLICATIONS find the one you are interested in.
2 Move slide until arrow points at selected application. The resulting number of the G-E varnish specifically designed for this application will appear in the window on top. Green triangles indicate additional applications for which the same varnish can be used.
3 See other side for Type of Base, Specific Gravity, Viscosity and Recommended Thinner.
Excellent
Good
G-E VARNISH NUMBER
1696
CHARACTERISTICS
Quick Drying
Flexibility
Toughness
Bonding
Film Building
Penetration
Dielectric Strength
Heat Endurance
Resistance to
Mineral Oil
Acid
Alkali
Moisture
Baking Time in Hours
110° C
125° C
135° C
150° C
8-10
6-8
3-5
Air Drying Time in Hours
RECOMMENDED APPLICATIONS
1. TREATING COILS AND WINDINGS
– Random-Wound Stators and Low-Speed Rotors
– Random-Wound High-Speed Rotors
– Form-Wound, High-Voltage Stators and Rotors
– Treating Complete Stators and Rotors
– Transformer Windings, Control Coils, Magnet Coils
– Large Field Coils, Brake Coils
2. INSULATING AND FINISHING COILS AND WINDINGS
– Quick Dry, Oil-Proof, Formex Windings
– Resistance to Oil, Weather, Moisture
– For Finishing Coils, Motors, and Compensators where baking is not practical
3. GENERAL REPAIR WORK
– Air Dry: Resistance to Acid, Moisture and Weather
– Air Dry and Quick Baking: Resistance to Acid, Moisture, Oil and Weather
• Higher Temperature Preferred. ‡ At High Temperature.
457 ½ Black
•954 ½ Yellow
RESIN AND INSULATION MATERIALS DIVISION • GENERAL ELECTRIC CO., SCHENECTADY 5, NEW YORK

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A quick glance at this handy, easy-to-use Varnish Selector gives you all the facts on 7 outstanding insulating varnishes — characteristics, applications, baking and drying time, base, thinner, viscosity — everything you want to know. Ask your local G-E Merchandise Distributor for one and you'll always have this essential information at your finger tips, ready to use. A list of G-E Distributors is available on request from Section RIMA652-30 Resin and Insulation Materials Division, General Electric Company, Schenectady 5, New York.

SEND THIS COUPON NOW TO YOUR LOCAL G-E MERCHANDISE DISTRIBUTOR

Gentlemen:

Please send me a G-E Insulating Varnish Selector as offered in Electrical World.

Name.....

Title.....

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GENERAL ELECTRIC

HOW TO OPERATE SYNCHRONOUS MACHINES WITH TEMPORARY GROUND ON THE FIELD

As developed and used by A. A. STRAUB, Engineer, Southern California Edison Co. Ltd.

Occasion may arise where it is desirable to operate a synchronous motor or generator temporarily with a grounded field winding until the machine can be taken out of service for repairs. A method for safely operating such a machine is presented.

Procedure

1. Install some economical ground protection to operate an alarm and trip the necessary circuit breakers to take the machine out of service should a second ground develop.
2. If resistance of accidental ground is sufficiently high to limit ground current to a value that will not damage the machine immediately, the alarm relay only will operate.
3. If the ground resistance is low, both relays will operate to sound an alarm and disconnect the machine from the line.
4. Equipment required is:

2—800-ohm telephone relays with pick-up value variable from 2 ma. to 6 ma. Western Electric type 196B relay is suitable.

1—Fixed resistor, 100-ohm, 100-watt.

1—Adjustable resistor, 100-ohm, 100-watt.

Note: Value of resistors is not critical. It is desirable that adjustable resistor have a maximum number of steps. Knife switches and terminals as desired.

Example

Assuming the first ground developed between poles No. 6 and No. 7 at "Y" as shown in sketch.

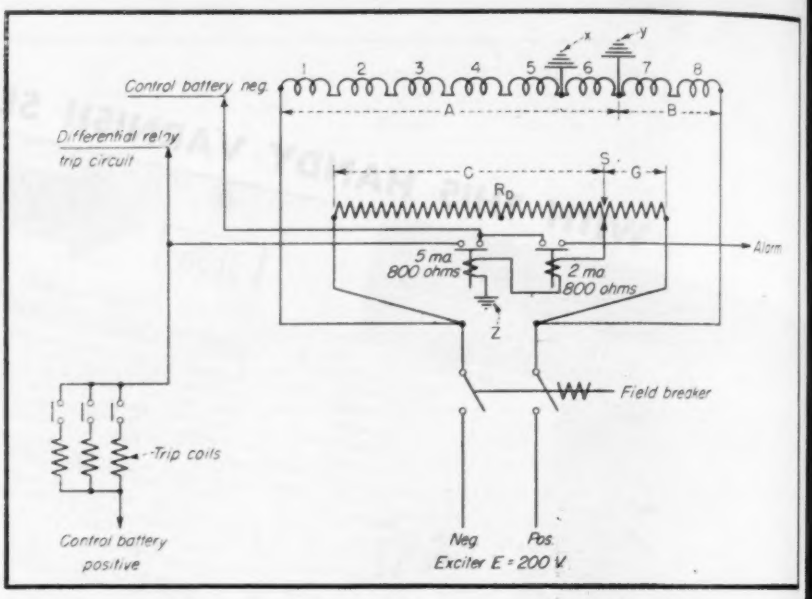
1. Connect the fixed and adjustable resistors in series across the field.
2. Connect the two relays in series from the adjustable resistor slide to ground.
3. Adjust slide until voltage drop across the relays is zero. This can be done without knowing the location of the field ground "Y".

Explanation

Assume normal field resistance of 0.8 ohm total or 0.1 ohm per pole and normal field voltage of 200 volts. By Ohm's law field current I_F is

$$\frac{200 \text{ volts}}{0.8 \text{ ohm}} = 250 \text{ amp.}$$

Volts drop E_A, from negative to ground "Y", is 0.6 ohm x 250 amp.=150 volts.



Volts drop E_B, from positive to ground "Y", is 0.2 ohm x 250 amp. = 50 volts.

Negative to positive resistance of ground detector R_D is 100 + 100 = 200 ohms.

Ground detector current

$$I_D = \frac{200 \text{ volts}}{200 \text{ ohms}} = 1.0 \text{ amp.}$$

Volts drop from negative to slide "S", is $E_c = \frac{I_F R_A}{I_D} = \frac{250 \times 0.6}{1.0} = 150$ volts.

Volts drop from positive to slide "S", is $E_{Pos} - E_C = 200 - 150 = 50$ volts.

The voltage drop values shown for the field and the ground detector with the circuit used will be readily recognized as a balanced bridge circuit using the ground detector relays in place of the conventional galvanometer.

Second Ground

If a second ground develops which for example is between poles No. 5 and No. 6 at "X", then the two grounds form a by-pass for pole No. 6. This reduces the resistance of the total field and increases the field current I_F, assuming the voltage E_F i maintained at a constant value of 200 volts. Then, if both field grounds have zero resistance, the resistance of the portion of the field occupied by pole No. 6 will be zero. Therefore, the total field resistance will be reduced to 0.7 ohm, and the field current will be

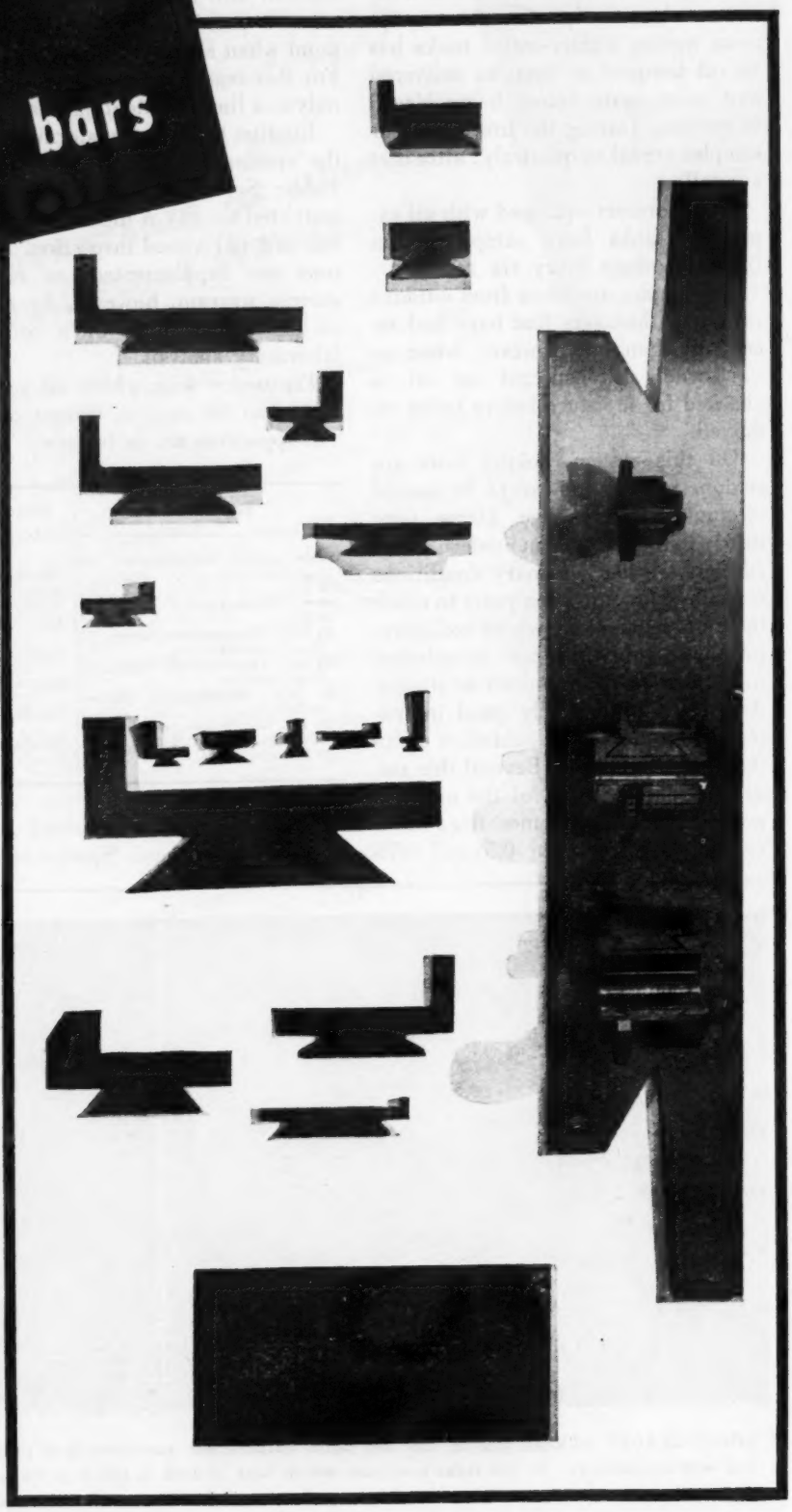
$$\frac{200 \text{ volts}}{0.7 \text{ ohm}} = 285.71 \text{ amp.}$$

The change in field current and field resistance will unbalance the bridge circuit and develop a voltage drop across the relay coils proportional to the ground resistance. The field resistance from negative to "X" will be that for five poles, or 0.5 ohm. E_A will be 0.5 ohm x 285.71 amp. or 142.85 volts. Ground detector volts E_A will not change from the original value of 150 volts. Therefore, the voltage drop across the relays will be $E_C - E_A$ or 150 — 142.85 = 7.15 volts. Total relay resistance is fixed at 1,600 ohms and relay current will be

$$\frac{7.15}{1600} = 0.00447 \text{ or } 4.47 \text{ ma.}$$

Recommended pickup value for the alarm relay is 2 ma. and for tripping relay is 4 ma.

For KNOW-HOW in commutator bars



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A Time Schedule for Oil Sampling

By A. D. THERRIEN
Northern Indiana Public Service Co., Hammond, Ind.

Prior to placing new equipment in service two oil samples are taken; one as soon as the apparatus is delivered and another after rain or snow. During the first half year, monthly oil samples are taken from new outdoor equipment. New equipment having tightly-sealed tanks has its oil sampled as soon as delivered and twice again before being placed in service. During the first half year samples are taken quarterly; after that annually.

Transformers equipped with oil expansion tanks have samples taken from the sump every six months.

No samples are taken from outdoor oil circuit breakers that have had recent oil changes. However, when an oil switch is inspected its oil is checked for moisture before being removed.

On this system, acidity tests are seldom resorted to except in special circumstances. Sludge forms very slowly in modern oils in modern transformers. Under ordinary conditions it probably requires ten years to reach the saturation point where oxidation products, until then held in solution in the oil, begin to deposit as sludge. Acidity tests are fairly good indicators of the degree of oxidation up to the saturation point. Beyond this saturation point acidity of the oil does not change but becomes fixed at a value usually between 0.5 and 0.75 NaOH. When saturation has been reached the only reliable index to the amount of sludge deposits is visual inspection. Acidity tests, therefore, are useful only before saturation is reached and then only to reveal the relative proximity of the saturation point when sludge starts to settle out. For this reason acidity tests are used only to a limited extent on this system.

Routine tests on transformer oil on the system of the Northern Indiana Public Service Co., Hammond, are restricted to: (1) A dielectric strength test and (2) visual inspection. These tests are supplemented, as circumstances warrant, however, by an occasional acidity test or a complete laboratory analysis.

Frequency with which oil samples are taken on various classes of system apparatus are as follows:

Equipment	Frequency
Water cooled transformers, all voltages	Monthly
132 Kv.	Monthly
132 Kv. (Sealed tanks)	Yearly
66 Kv.	Monthly
33 Kv. Transformers over 51 Kva., outdoor	Quarterly
33 Kv. Transformers under 51 Kva., outdoor	Semi-annually
33 Kv. Transformers (Sealed tanks)	Yearly
15 Kv. and below, transformers and regulators, outdoor	Semi-annually
33 Kv. and below, indoor	Yearly

This schedule is followed under ordinary conditions. Special circumstances may make it desirable to take samples more often than indicated. For examples where failure of the equipment would be very serious, from the standpoint of cost or service, samples are taken more often. Where a sample is found to contain moisture, samples are taken very frequently until the condition has been corrected.

In the case of water cooled transformers it is the practice to check oil level daily as a leaky water coil may be detected by a high oil level.

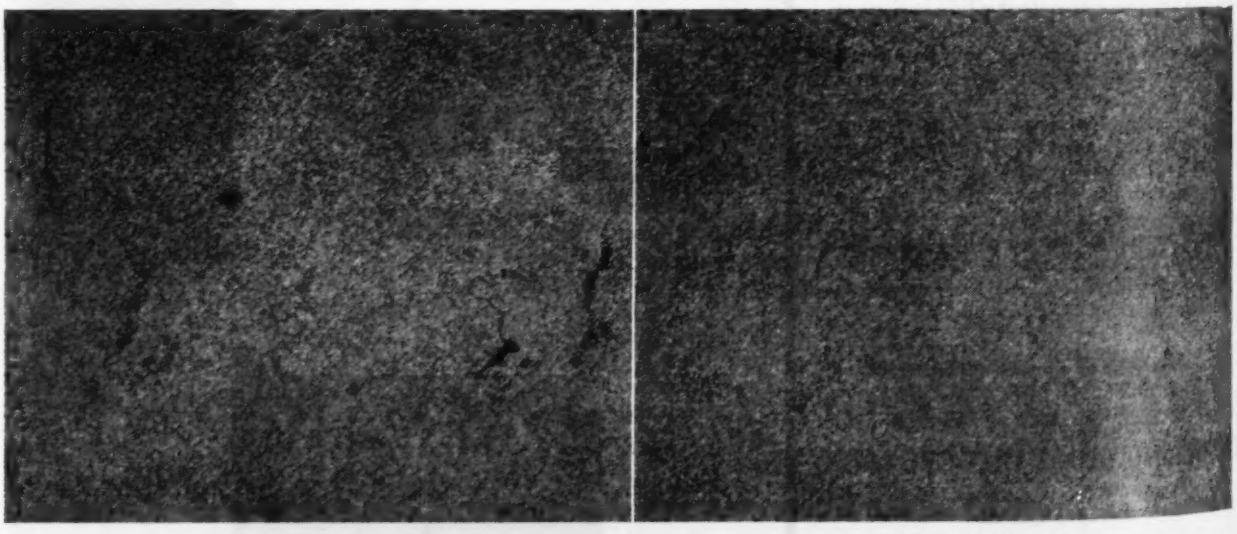
•

Photomicrographs Prove Need of Preheating

By ROBERT PASS.
Engineer
Tempil Corp., New York City

Visual evidence that carbon steels developed micro-cracks if welded without preheat is given by the accompanying photomicrographs. The results of internal stress, due to non-preheating, are evident in the left; absence of any appreciable internal stress, due to preheating to 200 deg. F., and homogenity of structure are evident in the right.

Temperature indication was obtained by making a crayon-like mark with Tempilstik 200 on the specimens. Heat was then applied until the mark melted to a liquid smear, and only then was the welding operation begun. When the smear solidified, which indicated that the temperature had dropped below 200 deg. F., more heat was applied until the liquid smear again appeared and the welding op-



MICRO-CRACKS DEVELOPED in the left plain carbon-steel specimen (0.20 percent carbon, 0.65 percent manganese) after welding without preheat. In the right specimen which was heated to 200 deg. F., no cracks appeared. Both pieces are 1½ in. thick, of the same composition and were welded by the use of ¼-in. diameter electrodes

APR 23 1947

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96.1% AVERAGE AVAILABILITY

NO.	STARTING MONTH	AVAILABILITY
1	January 1943	96.0*
2	February 1943	96.6*
3	May . . . 1943	95.8*
4	June . . . 1943	96.0*

*Including outages to make necessary changes and adjustments to perfect a new design.

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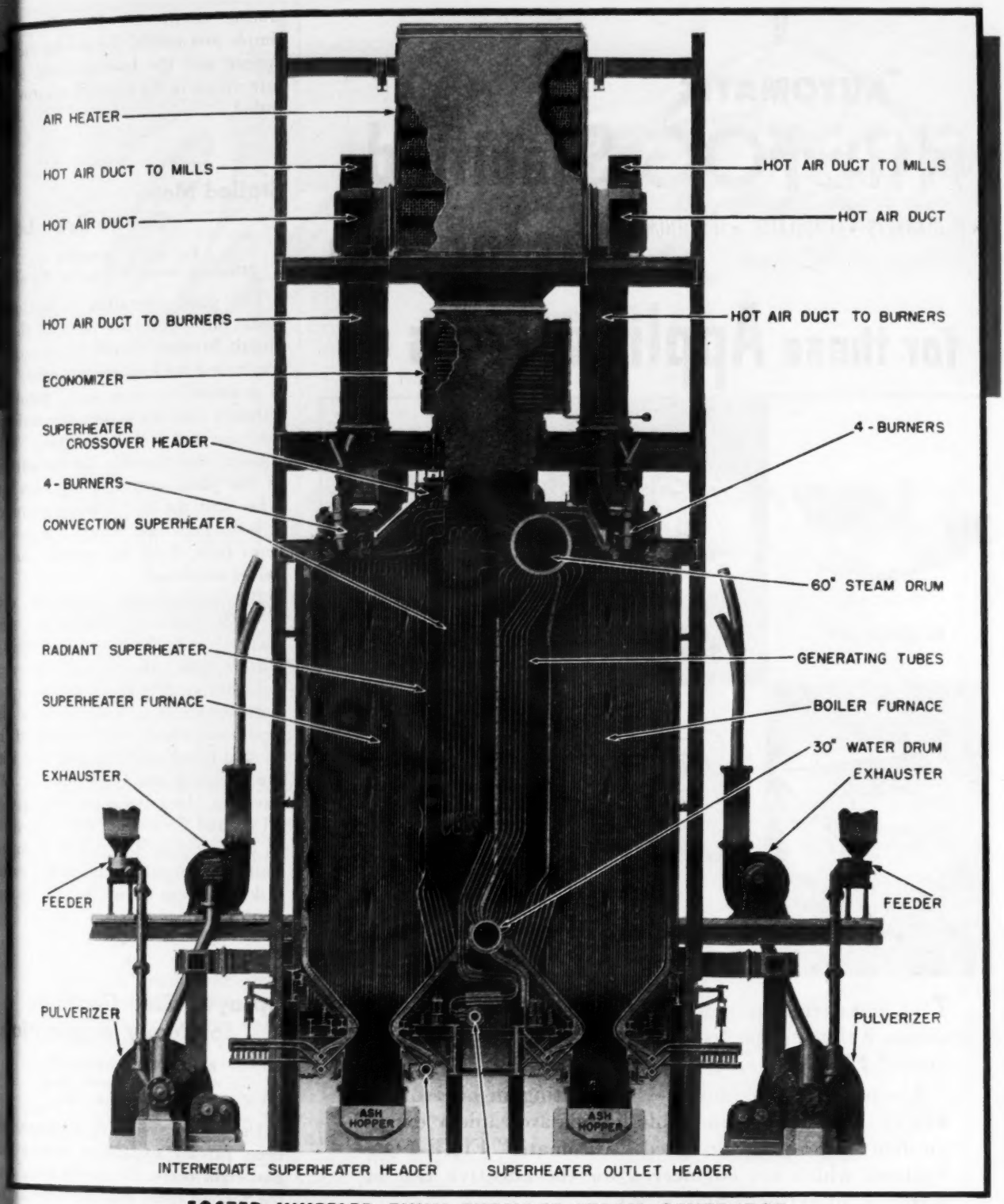

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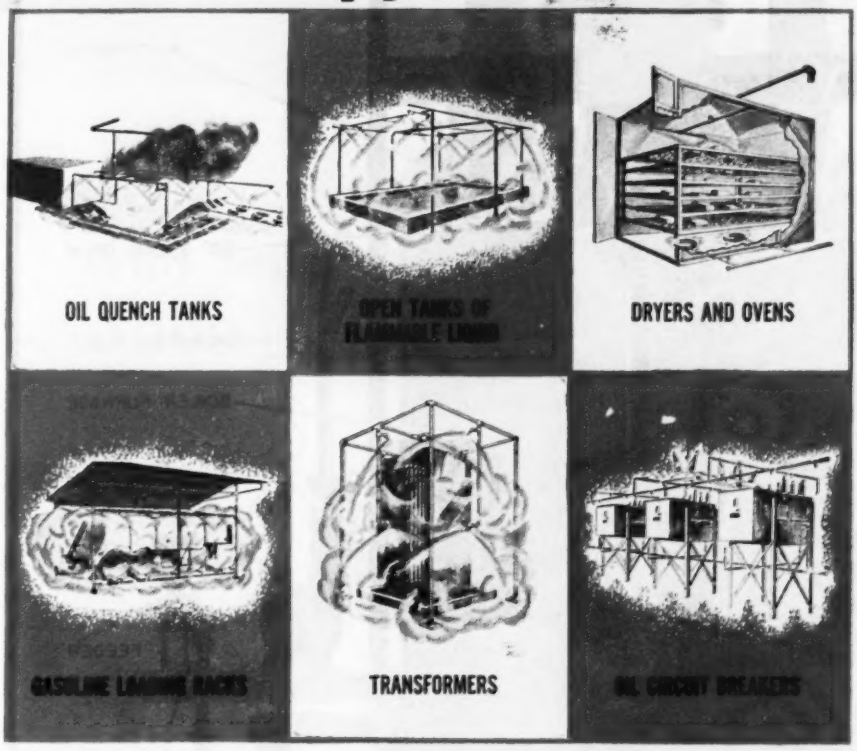

THE industrial equipments illustrated above are typical of many that are protected from serious fires by "Automatic" FIRE-FOG Systems.

Electrical blazes and fires originating in oil storage and open tanks of flammable liquids are rapidly extinguished by properly designed "Automatic" FIRE-FOG Systems which are engineered for the effective use of water as an extinguishing agent.

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"Automatic" manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, approved by Factory Mutual Laboratories.

eration continued. By taking this simple precaution, the cracks did not appear and the homogeneous structure shown in the right illustration resulted.

•

Stalled Meter Shows Zero Load

By G. I. SMITH
Minnesota Power & Light Co., Duluth

For good operation in taking a steam turbo-generator off load, the oil circuit breaker should be opened at the instant the load reaches zero. This is desirable so as to avoid throwing abruptly onto the system any residual load the unit may be carrying. It is equally objectionable (in the attitude of the plant operating engineer) to delay until the unit is being motored; it is to be avoided even for a very short time, if all the turbine control valves are closed.

But an indicating wattmeter with a 0 — 30 megawatt scale is not very accurate near the zero point, and is hard to read within 1 or 2 megawatts.

In our control room the generator watthour-meter is mounted on a vertical panel about five feet back of the control bench-board and in line with the governor and OCB controls. We have put black India ink dots spaced all around the edge of the lower disk. In dropping the last couple of megawatts, the operator watches the meter disk and opens the OCB at the instant that disk travel ceases.

•

Sprayed Zinc Coatings for Many Applications

By R. E. MARBURY
Westinghouse Electric Corp.
East Pittsburgh, Pa.

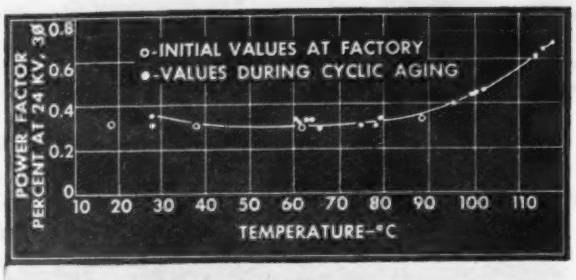
Use of sprayed zinc coatings has been rapidly expanding during the past eight years. By sandblasting and the Schoup spray process, zinc can be applied to any desired thickness and easily made several times as heavy as hot dipped galvanizing; thus giving a life which is proportionately longer.

This method of coating steel with zinc has been proven very effective on bridges, tanks, outdoor pole-line hardware and in a large variety of applications such as:

Anchors, meter boxes, sluice gates, lock and dam gates, wicket gates, metal window frames, telephone hard-

Oxidation CONTROL

with Type CB (CARBON-BLACK) CABLE



Cyclic aging tests have been conducted by a utility laboratory on Type CB (carbon-black) Cable at temperatures up to 117° C and at double operating voltage. At the conclusion of these tests, the power-factor/temperature characteristics were exactly the same as initially.

Not one report of electrical failure of Type CB (carbon-black) Cable in service!

Special, adsorbent carbon black prevents oxidation and breakdown of oil—Anaconda carbon-black paper adsorbs oxidation products caused by heat and electrical stress, and also reduces ionization discharges, dendrites, wax formation.

Can carry emergency loads safer—Type CB cable construction definitely increases high temperature stability of the cable. Accommodation is provided for emergency overloads which ordinarily may lead to excessive dielectric losses and permanent cable damage.

More for your cable dollar—Obviously Type CB Cable offers longer life and greater efficiency than ordinary paper-insulated cable. Ask to see graphic demonstrations of Type CB Cable superiorities. 45306

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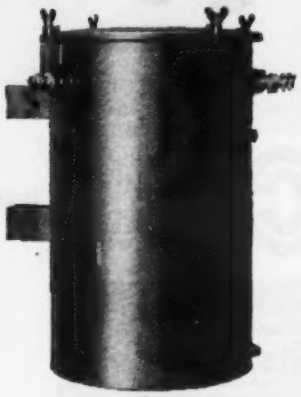
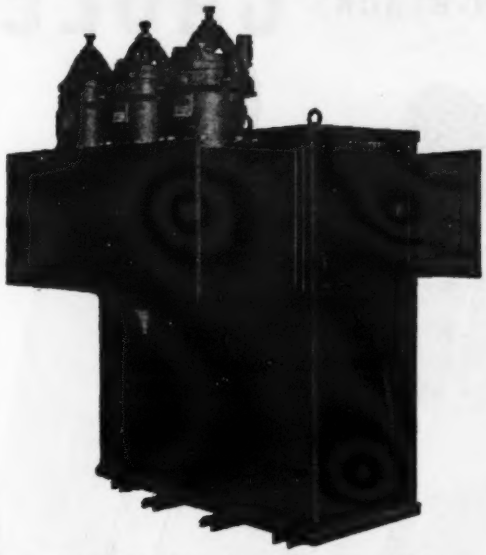
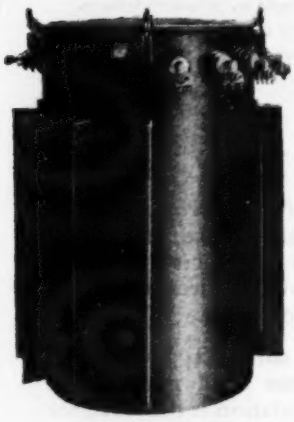


DAVIS 10 KVA, single phase, 7200-120/240 Volts, Oil-cooled



DAVIS 100 KVA, three phase, Class "B" Insulated, Dry Type, 4160Y — 208Y Volts, with special G&W oil fuse cutouts.



DAVIS 100 KVA, single phase, 2400-120/240 Volts Oil-cooled

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In addition to manufacturing new Davis units as illustrated, we have for years been "transformer repair headquarters" for leading utilities and industrial companies. We offer complete repair and rebuilding service. All work guaranteed same as that of original manufacturer. A large stock of used transformers for sale—similarly guaranteed. Write us.

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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION NEMA MEMBER

ware, transformer tanks, water tanks and troughs, gasoline tanks and drums, prefabricated steel swimming pools, steel stairways, mine cars, buoys, boat hulls and superstructures.

During the last two years large groups of outdoor capacitors have been assembled in steel structures to form capacitor banks of 10,000 to 20,000 kva. and perform the functions which previously were done economically only with synchronous condensers. The availability of this long-lasting zinc finish will promote an even more extensive use of the outdoor type of capacitor unit; not only in large banks but also in small pole-mounted groups on distribution circuits.

•

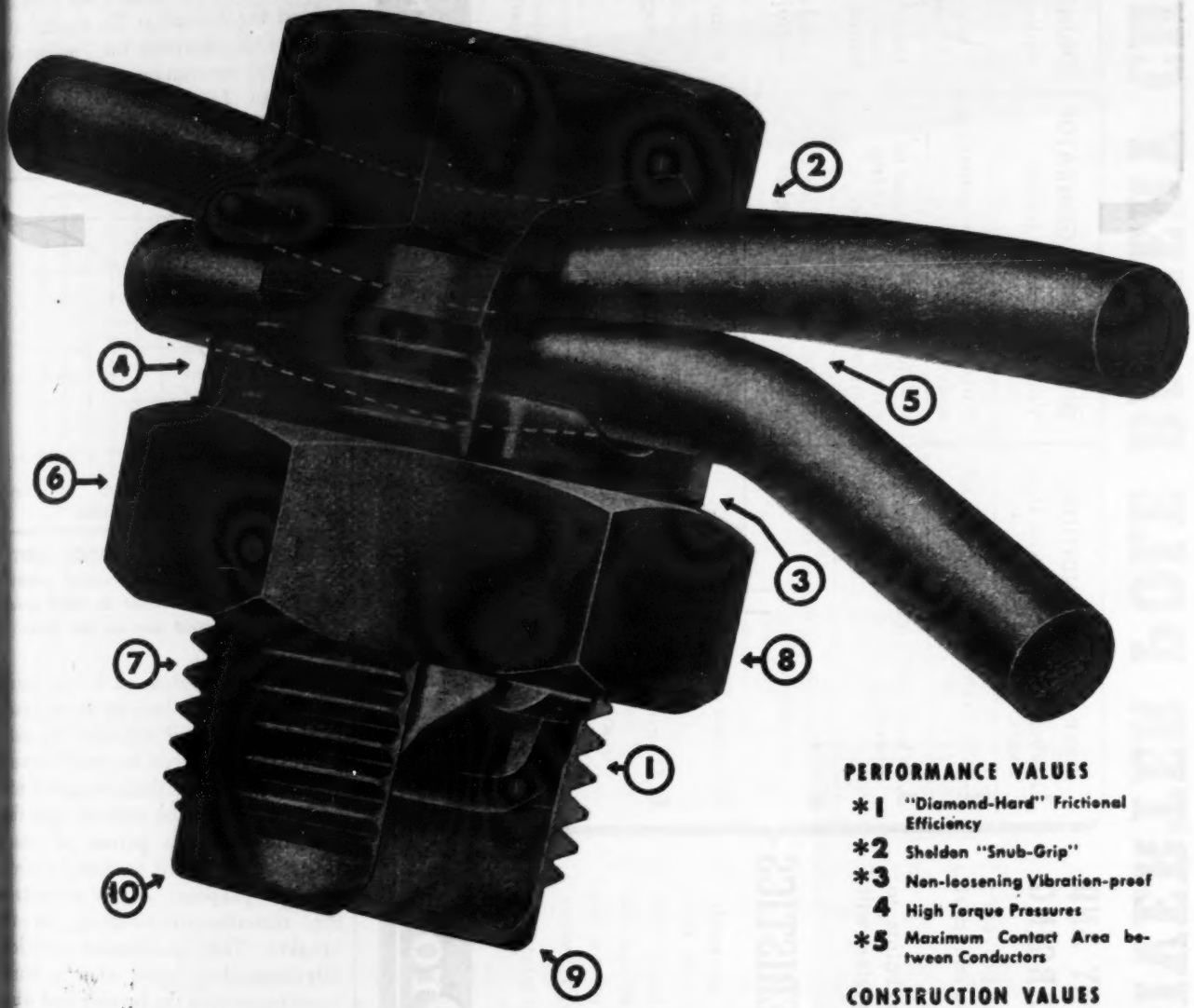
Cumulative Duty-Score Breaker Maintenance—II*

By O. E. FAWCETT
West Penn Power Co., Pittsburgh, Pa.

Maintenance units for fixing the program of circuit breaker testing are determined from an empirical curve plotted as follows: With maintenance units as abcissa and a ratio of amount of current interrupted to the rated short circuit current of the breaker as ordinates, it is assumed that when a breaker receives its full rated short circuit current once, it is due for inspection. It is further assumed that if the breaker received 70 percent of its rated short circuit current, it may be allowed two such operations before needing inspection and that if the breaker receives one-half rated current, it is assumed that it may be allowed four such operations before needing inspection. Through these three points, a smooth curve is drawn, after which, knowing the approximate short circuit current the breaker received, the maintenance units are readily available for recording on the card. When the amount of maintenance units charged against the breaker reaches 100, the breaker is considered as due for inspection. This, of course, requires knowledge of the amount of current interrupted at each operation of the breaker. Since the exact source of the fault may not be accurately known, it can be assumed in such cases to be in the center of the line which tripped and from calculation the current can be closely approximated. Any discrepancies in

* Part I, ELECTRICAL WORLD, May 26, 1945, page 105.

10 REASONS FOR SPECIFYING SHELDON SPLITBOLT CONNECTORS



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- *3 Non-loosening Vibration-proof
- 4 High Torque Pressures
- *5 Maximum Contact Area between Conductors

CONSTRUCTION VALUES

- *6 Made of the Best Material Obtainable
- 7 Sheldon Precision Manufacturing Throughout
- 8 High-Tensile-Strength Alloys
- 9 Nickless Corners
- 10 Corrosion Resistant

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SPLITBOLT connectors are operating equipment . . . and that's the way you should buy them! Check holding pressures . . . permanency of grip . . . machining precision . . . the host of factors that go into the manufacture of splitbolts. *Yes, check the ten features of Sheldon Splitbolt Connectors against any other make!* Sizes available: From 8 solid to 1,000 MCM. Write today for free testing samples. Sheldon Service Company, 652 Hudson Street, New York 14, N. Y.

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For "Reasons Why", review the Seven Points to the right. A quick check of your own system will verify these FACTS.

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● Diverter Pole Motor-Generators are an exclusive E. P. design, obtainable in capacities from 250 watts to 200 kilowatts . . in voltages from 5 to 500 . . . built "to order" to meet specific applications. They have been installed on the largest electrical systems built in the last 10 years

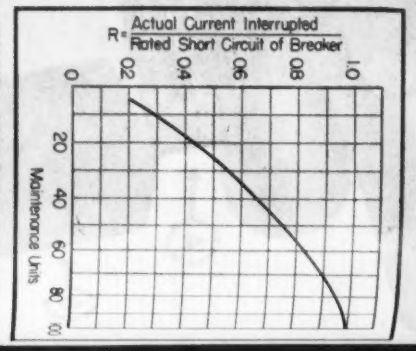
● *Specify E.P. Generators to get exactly what you want.* Write for list of installations.

OPERATING CONDITION	DIVERTER POLE GENERATOR	SHUNT-WOUND GENERATOR
1. When running at very light loads.	Voltage remains stable.	Voltage tends to fall.
2. When running at normal load.	Voltage remains constant under varying load.	Voltage varies with each change in load.
3. When oil circuit breaker is operated.	Furnishes current equal to its rated capacity helping to maintain bus voltage.	Furnishes practically no current — lower bus voltage as battery takes all the load.
4. Following oil circuit breaker operation.	Tends momentarily to come back to a slightly higher voltage.	Tends to come back at a slightly lower voltage.
5. Following power failure.	Will return to original voltage setting.	Tends to return to voltage lower than original setting.
6. Floating at 130 volts, for 60-cell batteries, but generator capable of operating at 170 volts.	Voltage stable	Voltage usually unstable.
7. Automatic sub-station.	Voltage remains constant month after month without field rheostat adjustment.	Frequent adjustment of field rheostat

X-1

The Electric Products Co. 1731 CLARKSTONE ROAD · CLEVELAND 12, OHIO

this approximation generally avera
out over the several operations nec
sary to build up 100 maintenance
units. The West Penn System ha
available a calculating board suitab
for determining the approximate sho
circuit current for all lines and tra
former banks on the system. One
the short circuit current has been ob
tained for a fault at the middle of
line, it is recorded on the breake
card and the number of maintenanc
units to be charged against the
breaker for any operation are th



CUMULATED MAINTENANCE UNITS proportioned to ratio of actual current interrupted by breaker to rated short circuit; inspection due on 100 units

recorded. Therefore, it is not nece
sary to each time look up the short cir
cuit received and calculate the ratio
of current received to rated curren

There is one further precaution ne
essary to keep the method operating
smoothly over a period of years
Rated short circuit current for main
tenance purposes is not necessarily
the manufacturer's rating on the
breaker. This is changed occasion
ally depending upon what is found
upon inspecting the breaker and wha
new improvements are made such a
adding De-ion grids, oil blast con
tacts, ruptors, etc., the short circui
current rating of the breaker is
changed to correspond with the ne
vamped breaker's ability to satisfac
torily interrupt faults. In only a fe
cases has it been necessary to con
sider manual operations of the
breaker. Breaking of load current
does become a factor in some case
On furnace circuits and some fe
others where a large number of ma
ual operations are required, it is som
times necessary to either charge fro
a twentieth to one maintenance un
per manual operation or place the
breaker on a periodic schedule.

YOU CAN KEEP *Moisture* OUT

WITH ANHYDREX Cables

- Wet or dry, Simplex-ANHYDREX Underground cables operate efficiently.
- They need neither lead sheath or other metallic protection from moisture.
- They may be installed with or without ducts.
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- Millions of feet of ANHYDREX cables were made and installed before the war.
- Thanks to Simplex laboratories and engineers, Simplex-ANHYDREX cables insulated with specially treated and compounded Buna rubber have the same high resistance to water absorption as the prewar product.

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ARMY ★ (E) ★ NAVY

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Simplex WIRES and CABLES

LOAD SERVICING

Commercial
Industrial

Residential
Rural

Aircraft Hinges Heated Uniformly

By L. M. DURYEE

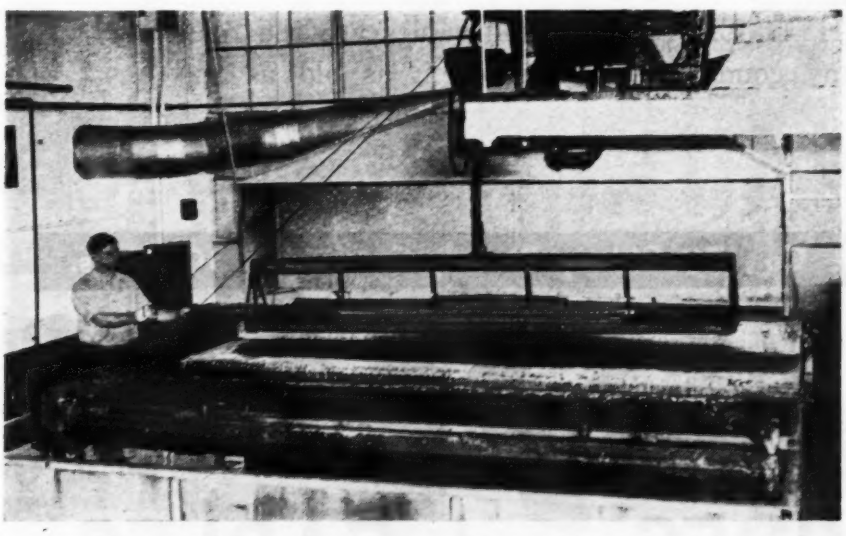
Industrial Power Engineer, Connecticut Light & Power Co., Waterbury, Conn.

Two years of operation have convinced the Homer D. Bronson Co., Beacon Falls, Conn., that the annealing of aluminum aircraft hinges can be done more satisfactorily and economically in an 85-kw., electrically-heated salt bath furnace on the premises than by sending the work to an outside job heat-treating plant. The furnace is equipped with 220-volt Calrod immersion heating elements which maintain practically a straight-line temperature of 935 deg. F. molten salt. The aluminum is treated to obtain a minimum tensile strength of 56,000 psi., and each hinge is anodized for surface hardness.

Each charge of hinges weighs 60 lb. and requires 20 min. for annealing. The 20-min. cycle for annealing requires an additional 5 to 10 min. for oil quenching and rinsing. The hinges are quenched in a quick-dip cycle in oil and then rinsed in hot water to remove all the oil and salt.

About 100 hinges of a standard 6-ft. length are required to make up the regular 60-lb. charge. All hinges come out bright and clean, and are wiped to remove any water spots. No scaling occurs because the neutral heat-treating salt effectively avoids oxidation. Care is taken to be sure that each charge is thoroughly rinsed after quenching, because if salt adhered to the surface some scale would be caused, which would be objectionable. Excellent uniformity of heat-treat is thus obtained, and clean surfaces are easily realized.

The full 85-kw. load (100 percent power-factor) on the furnace (made by the A. F. Holden Co., New Haven, Conn.) is either on or off, and is controlled by a Bristol potentiometer type of instrument operating a magnetic contactor. Anodizing is done in another department at 20 volts and a current density of 18 amp. per sq. ft. of surface. If further expansion were contemplated, the present set-up would be duplicated.



LOWERING A CHARGE into the salt bath to anneal 1,200 lb. of aluminum aircraft hinges per 10-hr. day. Each charge is then quenched and rinsed

Prepare Recommendations on Farm Welder Use

To promote uniform practices in selling and installing electric welding equipment by all branches of the electrical industry throughout the Minnesota area, the Rural Electric Equipment Council of the North Central Electrical Industries, Minneapolis, recently drew up detailed recommendations for the application and use of electric welders on the farm for maximum safety and service to the equipment user.

Highlights of the council findings which were published in full in a recent special N.C.E.I. bulletin, follow:

1. Sales and use of unapproved or homemade welders should be discouraged or prohibited.

2. Limitations of small, low-priced welders of the transformer type should be stated by the manufacturer and seller with special reference to safety measures.

3. Resistance-type welders are not recommended for farm or general use and the motor-generator type will probably find limited use due to its greater initial cost.

4. No welder having an input rating of more than 12 amp. at 110 v. should be used on an 110-v. outlet or circuit. Welders rated at more than 12 amp. should be equipped with a special 3-pole polarized plug for connection to a 220-v., 3-wire circuit.

5. For ordinary farm repair purposes, welders of 150-amp. rating should be capable as to performance for use on farms served by a 3-kva. or larger transformer. Where a 3-kva. transformer is already serving an electric range or other heavy duty equipment, an electric welder should not be used when such equipment is in operation; otherwise a larger transformer will be required. For custom repair shops the REA and other electric suppliers recommend as a general maximum, electric welders of 200-amp. capacity. Welders in excess of 200-amp. capacity may be installed only with special permission of the utility.

6. In all cases it is recommended that the customer notify his utility of intent to purchase and install an electric welder.

7. Power factor correction is desirable although not required by all REA projects or power companies.

8. All electric welders should be of

Your Heating Dollars will have MORE B.T.U. VALUE Invested in a C. M. HALL Radiair OVEN

C. M. Hall RADIAIR OVENS have always incorporated an engineered combination of infra-red radiant energy and the CONTROLLED movement of convected derived heated air.
THIS Productioneered OVEN CUT OPERATING COSTS 75%

Hall's enclosed-oven design offers substantial savings over open-type equipment. POSITIVE VENTILATION CONTROL equalizes oven temperatures, removes objectionable fumes and moisture — PRODUCES UNIFORM, FASTER FINISHING.

WHEN an industrial heating process reduces production time from hours to minutes and from minutes to seconds—THAT'S NEWS—MONEY-SAVING NEWS!

When that same process goes on to offer such additional advantages as LOWER EQUIPMENT, INSTALLATION AND MAINTENANCE COSTS, GREATER FLEXIBILITY AND EASE OF CONTROL, REDUCED SPACE REQUIREMENTS, SAFETY AND CLEANLINESS, it just stands to reason that there isn't a cost-conscious, production-minded man who can afford *not* to have *all* the facts concerning Infra-Red and its use as a production heating tool.

Any one of the above advantages alone is important enough to warrant consideration—combined, they represent heating economies and efficiencies which cannot be ignored. Yet, it must be kept in mind, that maximum time- and-money-saving benefits are obtained *only by the correct application of infra-red*, either in conjunction with present heating equipment, replacing present heating equipment, or when engineered to do a specific job of speeding up production processing.

This basic principle of correct usage governs the *productioneered* application of all C. M. Hall RADIAIR ovens. Radiant heating equipment as engineered for production by Hall is proving to be the new answer to many old unsolved problems in the field of heat transfer.

If your work involves preheating, dehydrating, drying or baking—CALL ON HALL for heating assistance.

"INFRA-RED AT WORK" *describes the many practical applications of this new production heating process.* SEND FOR A COPY TODAY.

. . . PRODUCED THESE

RESULTS!

2000 PCS. PER HR.
DRYING rubber cement on plastic rocket rings.

2400 PCS. PER HR.
DRYING Army Spec. 3-173, 3-181 paint on light metal stampings.

2800 PCS. PER HR.
DRYING Acid resistant paint on heavy metal stampings.

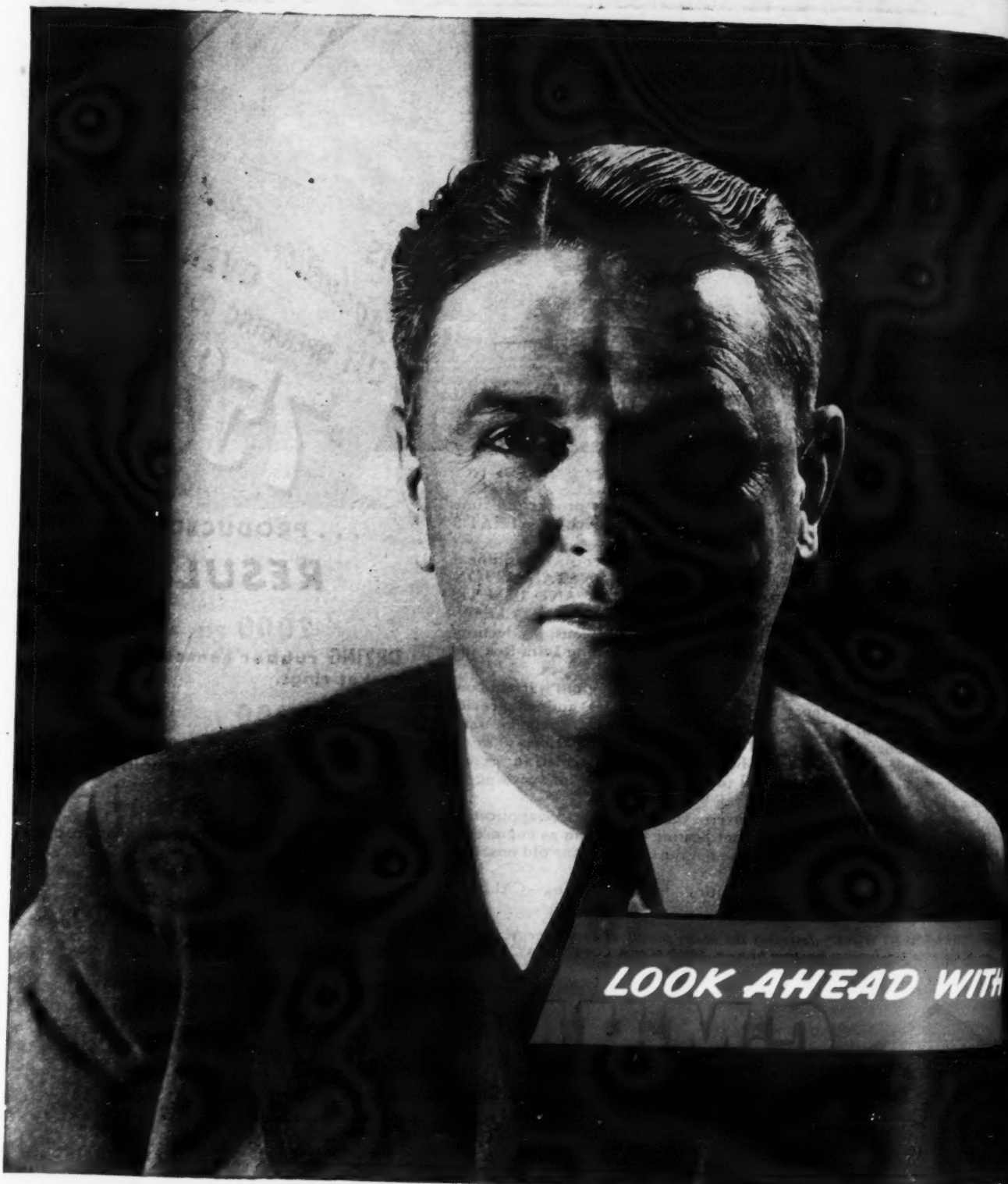
1800 PCS. PER HR.
BAKING synthetic enamels on sheet metal stampings.

C·M·HALL *Lamp Company*

PIONEER DESIGNERS AND BUILDERS OF INFRA-RED RADIANT HEATING EQUIPMENT

1035 EAST HANCOCK ST. DETROIT 7, MICHIGAN

"Never Let a Goo



lan Down!"

These words have a powerful meaning.

Here at Kelvinator they are part of our thinking—our way of doing business.

For they are the basis of the soundest franchise ever offered appliance dealers! A "Retail-Minded" franchise based upon the realization that the men who sell Kelvinator products are entitled to protection from unsound business practices and the *opportunity* for a sound business future.

Protection from the vicious competitive selling practices which result from too many dealers, too many models, and too few sales per dealer.

And opportunity to occupy a position of standing in the community, with permanency and an assured future that provides for the long pull, when the first flush postwar selling boom is over.

To provide that protection and opportunity, Kelvinator's "Retail-Minded" franchise provides for a completely selective dealer organization—an organization *not* of the greatest number but of the *finest* retailers ever assembled in the industry.

That franchise is the result of the feeling of every man in Kelvinator that *no sale should be considered completed until the product has moved out of the retailer's store.*

That's what we mean by "Retail-Minded" Kelvinator . . . a chance to build your future with a sound and progressive organization that will "never let a good man down!"

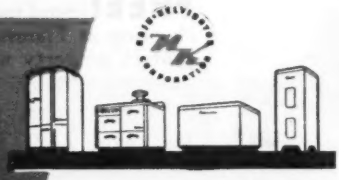
The most Valuable Franchise in the Appliance Industry

RETAIL-MINDED

Kelvinator

DIVISION OF NASH-KELVINATOR CORPORATION

Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing



Every Sunday 4:30-5:00 P. M. EWT for the new NASH-KELVINATOR RADIO SHOW, starring the ANDREWS SISTERS—Over the entire Blue Network

"THERE'S AN EXTINGUISHER EVEN I CAN USE!"

Employees are your real fire-fighters . . . and the fire extinguisher is their most effective weapon.

That's why safety men, everywhere, have made their fire defense easier and faster—with Randolph "4". Just ONE HAND snaps this extinguisher from its bracket . . . one trigger-touch sends fire-killing carbon dioxide deep into the blaze—in *split-seconds!*

A dry, odorless gas, carbon dioxide cannot damage equipment or conduct electricity. It leaves no stain or mess . . . actually disappears when the fire is out! *Approved by Underwriters' Laboratories.*

Randolph SIMPLIFIES FIRE-FIGHTING

FREE! Send me your new, 16-page booklet "Sharpshooting at Flames." Illustrates how to fight fires and protect property with fast-action carbon dioxide gas.

Name_____

Address_____

RANDOLPH LABORATORIES, INC. 8 EAST KINZIE STREET CHICAGO 11, ILL., U. S. A.

approved construction as evidenced by the Underwriters label or other competent agency.

9. The requirement for safe and adequate wiring should be set forth in all consumer's literature and installation books for electric welders rated in excess of 12 amp., 110 volts in substantially the following form:

"This welder must be connected to a special 220-volt circuit, in accordance with state or local wiring regulations. Consult your REA or power company or a competent electrician about the wiring you may need."

10. In general, the size of wiring for circuit supplying welders will be as follows:

Welder rating:	Required wire size:
100-125 amp.	No. 10
150-160 "	No. 8
200-260 "	No. 6

Switches used for control of transformer-type arc welders should conform to section 3816 of the National Electric Code (1945 Revision). Instructions should warn users not to disconnect welders by pulling out the receptacle cord or plug in case of "freezing."

Participating in the meeting of the Rural Electric Equipment Council meeting that drafted these recommendations were representatives of: REA and commercial utilities, University of Minnesota Farm School, State Board of Electricity, Underwriters Inspection Bureau, Electrical inspectors equipment manufacturers and distributors, farm publications, electrical contractors and dealers as well as several farmers.

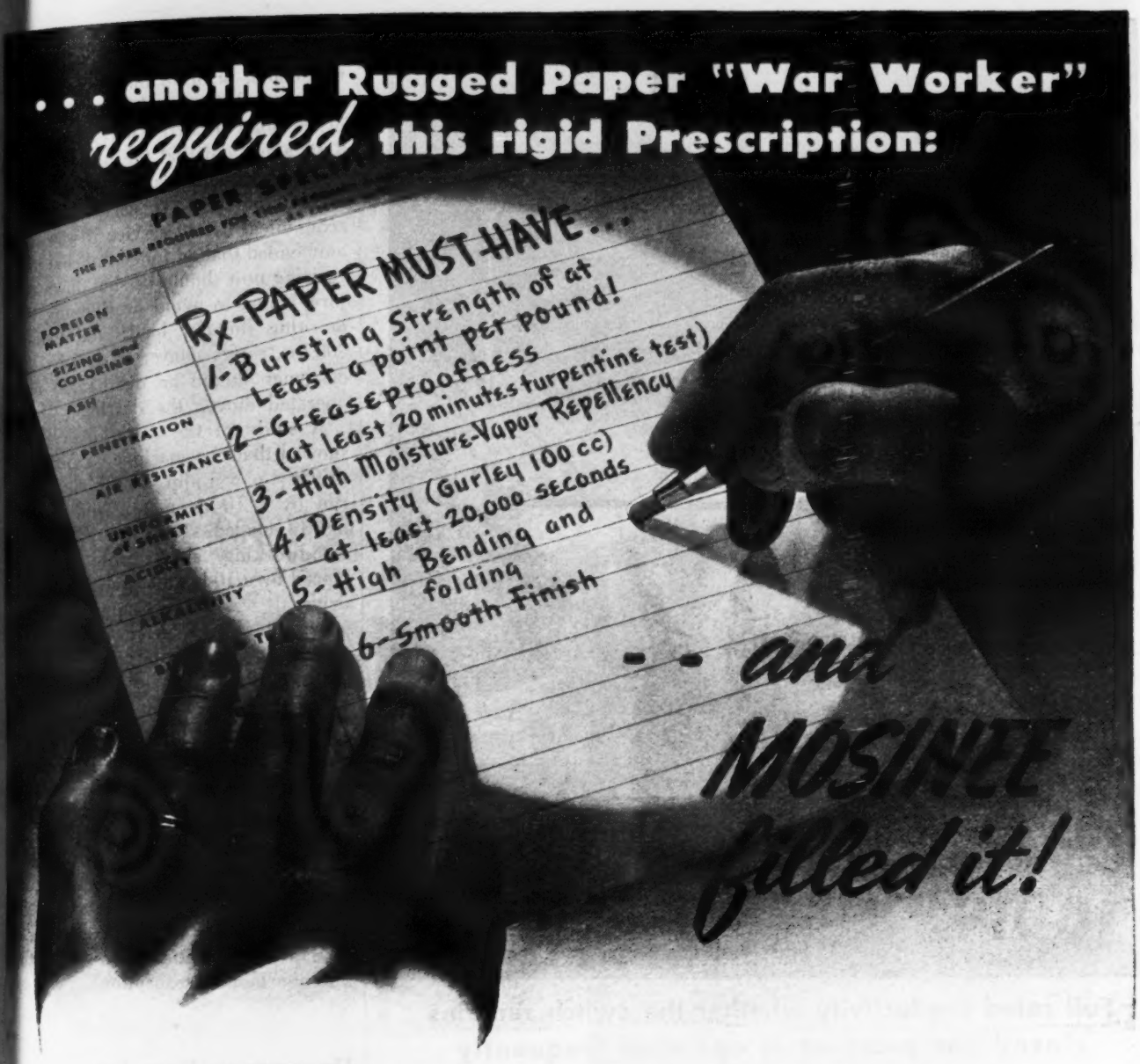
The North Central Electrical Industries, W. A. Ritt, secretary-manager, which sponsored this activity, is a regional association comprised of groups representing electrical contractors, dealers, utilities, manufacturers and distributors in Minnesota and surrounding states.

•

Improving Foundry Service

In examining the records of service to a foundry having a demand running between 500 and 580 kw., several lines of improvement were noted which were thought worth considering in later installations supplied from a local utility. The rate made it advantageous to the customer to keep his demand as low as possible and to maintain a power-factor of 80 per-

. . . another Rugged Paper "War Worker" *required* this rigid Prescription:



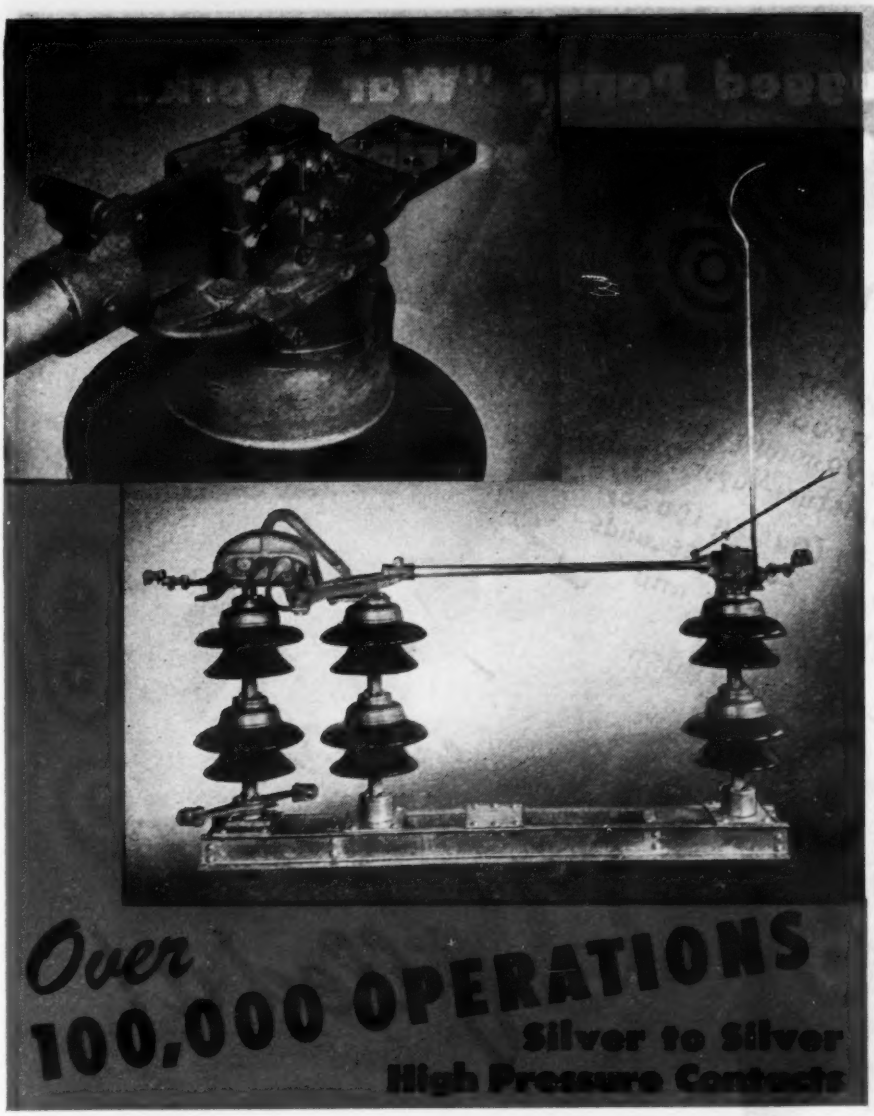
Food containers for our armed forces must be engineered to resist the ravages of all climates and extremes of conditions . . . for no one knows, in advance, the ultimate destination of the shipments. Extensive research, much effort and money have been invested by the paper industry to provide containers that assure arrival of food in fine condition.

MOSINEE, engineered to the above prescription, is a development of paper technicians at the Mills of Mosinee . . . an important contribution to this field . . . "Essential Paper" that combines greaseproofness and high density, while retaining the basic strength of the sulphate fibre for improved bending, folding and scoring.

Mosinee engineers will be glad to discuss this product with you, and offer extensive experience and facilities in creating specific papers or improving your processing.

Please address your letter "Attention Dept. 8"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers



Full rated conductivity whether the switch remains closed for years or is operated frequently

The contacts of Hi-Voltage Switches are line type, self-aligning and self-cleaning. A ductile powdered metal alloy of silver and nickel is brazed to the copper parts. The silver alloy combines the permanent low resistance contact of fine silver with the non-gauling, long life characteristic of the silver-nickel alloy. The work hardening characteristic of nickel in the alloy produces a hard contact surface. The nickel also imparts to the contact material a lubrication effect.

Positive pressure to develop the maximum conductivity is maintained by stainless steel springs.

The contact cannot be damaged by closing a circuit of thousands of amperes or in opening under heavy load. They are protected by three auxiliary contacts — the horns — the base guide for the blade — and the bronze sleet hood.

In short Hi-Voltage attention to details results in contacts which maintain conductivity—through a life beyond that of the station.

HI-VOLTAGE
EQUIPMENT COMPANY
2891 East 79th Street • Cleveland 4, Ohio

cent or over. At the time the study was made, prior to the present war, it appeared that the higher demands of the load occurred between 7 and 8:30 a.m., and that the power-factor of these demands ranged between 68 and 76 percent. To secure a more economical use of service it was recommended that an industrial coal pulverizing unit should be shut down before 7 a.m. to avoid overlapping the morning foundry load; and that a 200-kw. rotary converter used by the customer should be overhauled and operated during the daytime.

A study of the motor operations showed that one machine (a Muller) driven by a 15-hp. motor could be run by a 10-hp. motor, and that a lightly loaded 20-hp. motor in the woodworking shop could be replaced by a 10-hp. alternating current drive. It was also recommended that in case the direct current load proved too heavy for the rotary, some of the existing direct current drives could be changed to a.c., notably in the core room. A small rotary converter improved the power-factor to over 80 percent. The initiation of some of the improvements was followed at once by a betterment of power-factor, and in a typical month the billing demand of 574 kw. was the lowest for nearly a year, although accompanied by a total input of 156,000 kw.-hr., a record consumption for a year with but one month's exception.

•

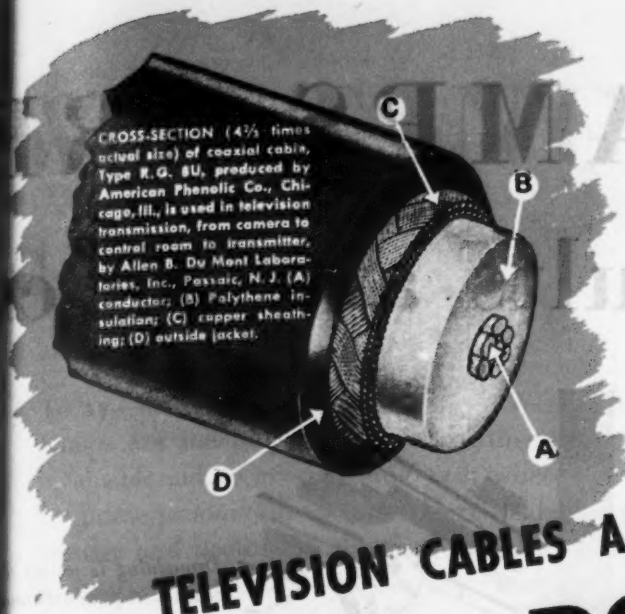
Uncommon Uses for H. F. Heating—V*

By E. D. JILLSON
Testing Engineer
Commonwealth Edison Co., Chicago, Ill.

To demonstrate the range of application that dielectric and induction heating methods offer in meeting industrial problems a series of cases have been selected from the many application studies conducted by Commonwealth Edison Co. as a service for their industrial customers in the Chicago area. Previous installments of this series have analyzed and reported on eight cases in which both dielectric heating and induction heating have been successfully applied.

Case 9. In the illustrated mold for the centrifugal casting of steel parts, polystyrene patterns are used instead

* Based on paper presented by the author before "High Frequency Heating Conference" sponsored by Great Lakes Power Club and Chicago Lighting Institute.



CROSS-SECTION (4⅓ times actual size) of coaxial cable, Type R.G. 8U, produced by American Phenolic Co., Chicago, Ill., is used in television transmission, from camera to control room to transmitter, by Allen B. Du Mont Laboratories, Inc., Passaic, N. J. (A) conductor; (B) Polythene insulation; (C) copper sheathing; (D) outside jacket.

FOR LOW POWER LOSS AT HIGH FREQUENCIES

TELEVISION CABLES ARE INSULATED WITH

Du Pont POLYTHENE

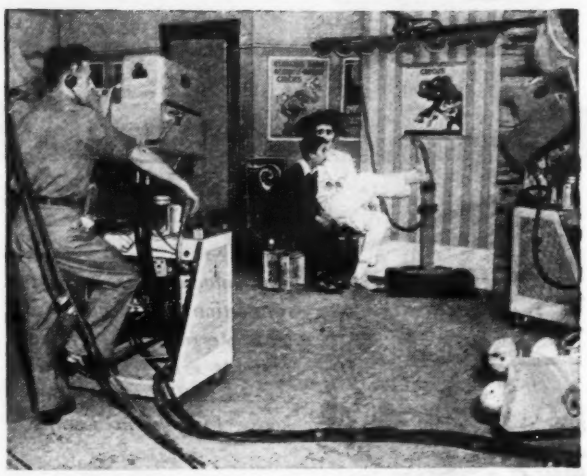
SOME OF THE CIRCUITS used in television transmission carry electrical current which changes its direction at the rate of 100 million cycles per second. This extremely high frequency is one of the chief reasons why polythene, a versatile Du Pont plastic, is chosen for insulating coaxial cables used in television transmission.

Polythene is non-polar. Unlike most other insulating materials, its molecules are not influenced by the cycles of oscillation of a current—no matter how rapid.

For this application, polythene's non-polarity is perhaps the most striking advantage. It is far from being the only advantage. Consider, for instance, these others:

1. **Polythene's dielectric constant (2.2—2.3) and its power factor (less than 0.0005) *remain almost constant over a wide range of temperatures, from—50°F to 220°F.***
2. **Polythene's specific gravity is 0.92.**
3. **Polythene has outstanding chemical inertness.**
4. **Its moisture absorption is less than 0.005 per cent.**
5. **Polythene is flexible over a wide range of temperatures.**

This unique combination of properties is responsible for polythene's displacement of other materials in insulating high-frequency wires used by the U.S. Army Signal Corps. This same combination of properties will see polythene advancing into many other fields as soon as it is less urgently needed on the war fronts.



Du Mont Portable Television Equipment in Studio Use.

Du Pont is now producing polythene under WPB allocation. Quantities up to 25 pounds for experimental purposes can be obtained according to WPB Order M-300, Schedule 60. Write for properties chart and other data to E. I. du Pont de Nemours & Co. (Inc.), Plastic Department, Arlington, N. J.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

For Plastics—consult **DU PONT**

ALWAYS A GOOD BUY — WAR BONDS

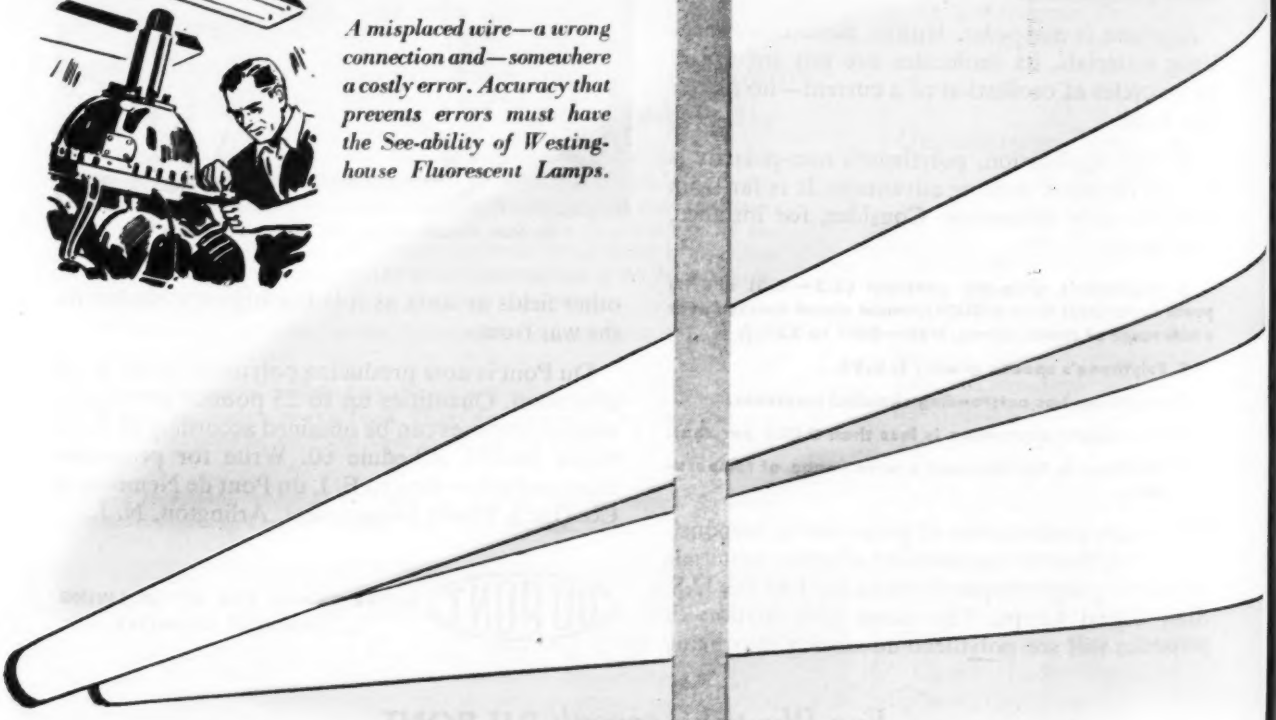
THE LAMPS ARE

...the results are better

Eyes like these must be sure. And they are sure—without strain or fatigue—because See-ability makes every adjustment clear and sharp, helps maintain high speed efficiency.

Draughting is an art that reaches its peak only under the finest lighting conditions. Westinghouse Fluorescent Lamps provide the See-ability that work like this demands.

A misplaced wire—a wrong connection and—somewhere a costly error. Accuracy that prevents errors must have the See-ability of Westinghouse Fluorescent Lamps.



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WESTINGHOUSE

See-ability

Today—in every branch of industry—Westinghouse Fluorescent Lamps are meeting industry's lighting needs—are providing invaluable aid to every seeing task where speed and precision are prime production factors. Alert dealers are building prestige and profits on the firm foundation of an adequate supply of these dependable lamps.

Throughout industry—wherever you go—industry is demanding top grade lighting. Sell Westinghouse Fluorescent Lamps and meet this demand—completely!

Office workers respond to the better See-ability of Westinghouse Fluorescent Lamps. More contentment—more speed—fewer mistakes when the lighting problem is solved.

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

MAZDA LAMPS FOR SEE-ABILITY

IT'S THE RIGHT KIND OF RADIANT HEAT!

INFRA-RED EQUIPMENT MANUFACTURERS and PAINT MAKERS CAN AGREE ON PENETRAY

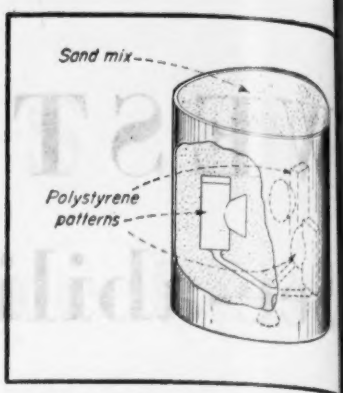
No longer is "passing-the-buck" a game to be played by paint men versus equipment men. No longer is the "buyer" in the middle as to whether paint or equipment is responsible for unsatisfactory results.

Penetray's exclusive ceramic coating improves wavelength, producing more intensive color, thorough curing and superior polymerization on metals. In addition, insect attraction is minimum because glare is reduced and improved uniformity of energy distribution results. Prove these points. Make your own tests for color and gloss; for corrosion and abrasives.

SALES ENGINEERS WILL CALL or DETAILS on REQUEST

LEARN TO SAY
PENETRAY

VERD-A-RAY
CORPORATION • TOLEDO 5, OHIO

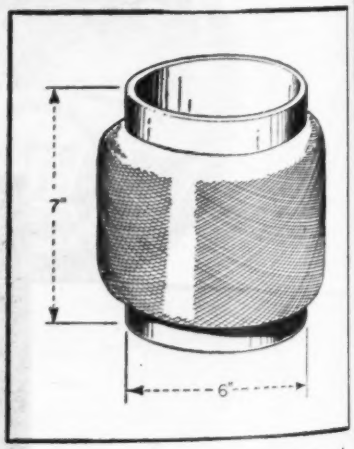


CASE 9—Induction heat applied to steel mold casing melts out styrene pattern

of wood. As shown, the sand mold is enclosed in a 14-gage, sheet metal cylinder. Before casings can be made the styrene patterns must be melted out of the mold. This was done by applying induction heat to the metal cylinder.

A slow rate of heat application is required, at the start, to prevent excessive moisture and alcohol in the sand mix from exploding the mold. On samples, the ideal combination seems to be four 1-min. cycles separated by 1-min. intervals. The method formerly used required from 1¼ to 1½ hr. to melt out the styrene.

Case 10. Dielectric heating was successfully applied in this case, to the removal of moisture from one pound of nylon thread on a spool of Kraft paper and bakelite varnish. Original moisture content ranged between 15 and 20 percent. While it was necessary to heat the spindle as well as the thread, the moisture was removed in 3½ min. Five thousand pounds of thread are produced in an 8-hr. day. Tests by others indicate there is no deterioration of material due to heating.



CASE 10—Dry pound of nylon thread on spool in 3½ min. by application of dielectric high frequency heat

FRIGIDAIRE DEALER
OPERATING GUIDE
SERVICE SECTION
THE FRIGIDAIRE SERVICE BUSINESS AND ITS PROFIT OPPORTUNITIES
... FACILITIES REQUIRED ... SELECTING, TRAINING AND COMPENSAT-
... SERVICE PERSONNEL ... ESTIMATING PARTS REQUIREMENTS AND
MAINTAINING PROPER INVENTORY ... SELLING SERVICE ... HANDLING
SER... CALLS .. GENERAL SERVICE POLICIES ... APPLIANCE SERVICE
...MERCIAL AND AIR CONDITIONING SERVICE POLICIES
... NATIONAL USER SERVICE POLICIES.
CHAPTER I
CHAPTER II
CHAPTER III
CHAPTER IV

Here's why Frigidaire Dealers everywhere are saying "It's the greatest thing we've ever seen!"

"Most outstanding piece of helpful literature ever presented to the Service Dealer Organization; another 'Frigidaire First'."

"Complete in every detail. A fine piece of material to place in the hands of both old and new dealers."

Comments like these show how enthusiastically Frigidaire service people in the field are hailing the unique Service Section of Frigidaire's new Dealer Operating Guide.

There's good reason for their enthusiasm. For this book offers practical help and authentic information on every phase of the service business—

An entire chapter explains service department arrangements, provides information on equipment and tools. Another chapter shows how to select and train service personnel, compares the advantages of various serviceman-compensation plans. Still another chapter shows how to operate a record system on service parts, gives useful tips on ordering parts . . .

Two invaluable chapters point out special opportunities for selling service, show how service calls can lead to future equipment sales, give reliable advice on establishing—and collecting—service charges . . .

Available Only to Frigidaire Servicing Dealers and Authorized Service Stations

This exceptional Service Guide condenses into one practical, usable volume the service "know how" of hundreds of Frigidaire Dealers . . . the fruit of more than 25 years of service experience . . . the vast technical knowledge of the entire Frigidaire Service Organization. Another exclusive advantage for the *Frigidaire* Dealer, it's one more reason why Frigidaire Dealers will continue to enjoy the kind of service leadership that pays off in . . . *Sales Leadership!*

Look to Frigidaire for Leadership through . . . DEALER AIDS!

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Division of
GENERAL MOTORS
DAYTON 1, OHIO • LEASIDE 12, ONTARIO
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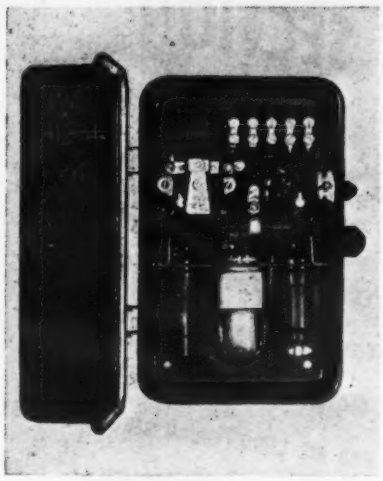
REFRIGERATORS • RANGES • WATER HEATERS
HOME FREEZERS • ICE CREAM CABINETS
COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

NEW EQUIPMENT

Photoelectric Control



Type "A20C" photoelectric control: 115-v., 60-cycle supply; relay contact cap. 10 amp. **Photoswitch Inc.**, 77 Broadway, Cambridge 42, Mass.

Unit provides automatic control of pouring operations in foundries. Pouring is started by pushbutton control of the hydraulic actuating mechanism and, when the molten metal reaches the riser of the mold, the radiating light is "picked-up" by the photoelectric cell. This causes a relay response which drops the ladle back and pouring automatically stops.

•

Work Positioner

Powered welding positioner: ½ hp., 110, 220 or 550-v. motor; work wt. cap. 700 lb., speeds zero to 2.4 r.p.m. in either direction. **Standard Machinery Co.**, Providence 7, R. I.

Work mounted on the table is said to be tiltable to any angle which permits the welder to operate from one position. Starting, stopping and reversing of table travel is provided by a foot operated switch. Table height is adjusted between 30 and 36 in. above floor level by an elevating screw. Mechanism is enclosed for safe operation and all moving parts are said to be protected against splash from molten weld rods.

•

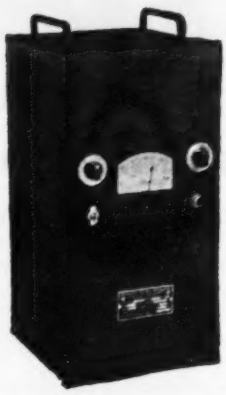
Dust Collector

"Tubular Dustex" dust collector: fireproofed; motors ¾- and 1½-hp.: 220-440-volt, 3-phase 60 cycle, **Dust Filter Co.**, 160 N. LaSalle St., Chicago 1, Ill.

Unit is said to collect and retain any type of dust or lint. Large unit is said to have 60.8 sq.ft. of filter surface area which is tubular in design and bottomless. Dust is collected in a pan at the bottom of the unit. Filtered air is discharged through a large muffler to deaden air noise.

•

Voltage Regulators

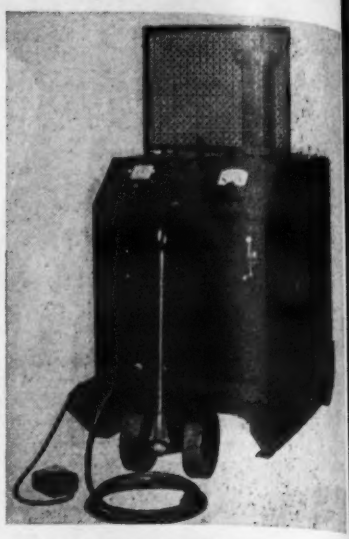


Models "4101" and "4102" automatic voltage regulators: 1- and 2-kva. capacities. **Superior Electric Co.**, Bristol, Conn.

Units consist of a thyratron tube circuit which controls a variable transformer. It is said to maintain a constant output voltage with input voltage and output current variations. Unit is claimed to be unaffected by changes in load power factor. Units are available in a cabinet for table or wall mounting and on a relay rack panel for mounting on existing equipment. They are supplied with voltmeter, "on-off" switch, sensitivity control knob and output voltage control knob mounted on front panel.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

A.C. Test Set



Portable set test: 100,000 volts; cap. 10 kva.; 6 ft. high, 5 ¾ ft. long and 2 ¼ ft. wide; supply 230-volt, 60 cycle current; **General Electric Co.**, Schenectady, N. Y.

Unit reported as suitable for conducting tests on large high-voltage motors, generators, circuit breakers, bushings and cable. It consists of an oil-immersed step-up transformer, hand-operated induction regulator, double-scale output voltmeter, clock, overload relay with automatic reset, and a two-pole magnetic contactor. Among safety features reported are a foot switch which must be depressed to energize the set and a protective screen between operator's working area and the high voltage bushing.

•

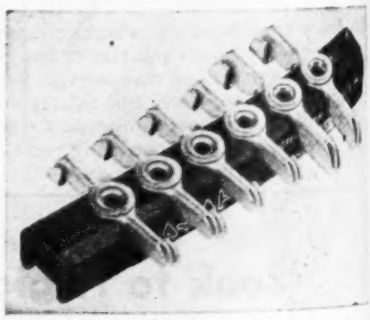
Fluorescent Fixture

Model "Quick-Liter" fluorescent fixture: one size accommodates two 40-watt lamps, another, four 40-watt lamps; 115 or 230 volt, 60 cycles. **Edwin F. Guth Co.**, 2615 Washington Ave., St. Louis 3, Mo.

Unit has "lateral ribs" which are said to serve as do the metal corrugations in a metal barrel. Unit is reported as a combination "hot" and "cold" cathode fixture. Lamps are said to start without flicker, to operate at zero deg. F, and at low or irregular voltages.

•

Connector Strips



Connector strip: accommodates wire sizes from No. 22 to No. 10 inclusive. **Aircraft-Marine Products, Inc.**, 1595 N. Fourth St., Harrisburg, Pa.

Connector strip which is designed for use with the company's solderless knife-disconnect splicing terminals, is said to afford

HUBBARD AUTOGAP FUSE CUTOUT

NO. 2315

HUBBARD AUTOGAP FUSE CUTOUT is a combination of No. 2302, 9 KV Autogap Lightning Arrester with a new, improved 7-1/2 KV open type fuse cutout. The assembly is Stock No. 2315.

VOLTAGE, phase to ground is recommended to be limited to 7500 Volts.

FUSE rating is 50 Amperes. Fuse links are not furnished. Any standard can be used.

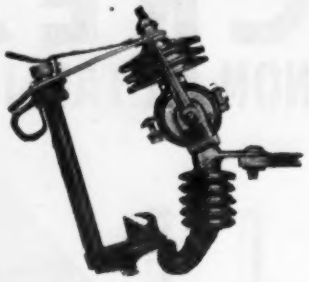
INTERRUPTING CAPACITY of the Hubbard Autogap Fuse Cutout is 1200 Amperes.

MOUNTING Brackets are available. No. 2323 for Crossarm and No. 2325 for pole. Specify type of mounting when ordering.

WEIGHT of the assembly is 18 Pounds each, packed for shipment.

HUBBARD AND COMPANY

PITTSBURGH · CHICAGO · OAKLAND, CALIF.



CLOSED POSITION: The flat, phosphor bronze spring at the top is in tension, ready to kick out the mechanism instantly when the blowing of the fuse releases the tension.

OPERATING: This view shows the action during transition from "closed" to "open" positions. The fuse has blown and the toggle mechanism is forced open by the top contact spring. The gap caused by the blown fuse is instantly lengthened to at least 3-inches by the leverage of the toggle mechanism, causing the arc to be extinguished within the fibre fuse tube rather than at the top contacts, where burning might occur.

OPEN POSITION: Top contact spring is relaxed, having exerted its pressure toward opening the mechanism. Tube drops to hanging, open position which places the notch for "hot-stick" removal of fuse tube in an accessible spot

● RUBBER POWER CABLES ● VARNISHED CAMBRIC CABLES ● PERMACORD ● LEAD-ENCASED AND PARKWAY CABLES ● SYNTHOL WIRES ● WELDING CABLES ● SHIPBOARD CABLES ● IMPERIAL NEOPRENE JACKETED PORTABLE CABLES ● ARMORED CABLE ● CRESFLEX NON-METALLIC SHEATHED CABLE ● SERVICE ENTRANCE CABLE ● BUILDING WIRE

CRESFLEX
NON-METALLIC SHEATHED CABLE

FACTORY ASSEMBLED AND TESTED

EASILY INSTALLED AT LOWEST COST

TOUGH PAPER ARMOR

WEATHERPROOF FLAME-RETARDING JACKET

Particularly well suited for wiring farm buildings and low cost housing.

CRESCENT
WIRE and CABLE

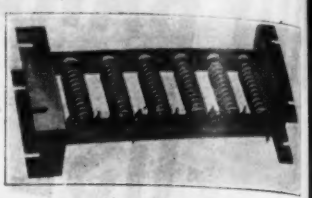
NEMA

CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

quick assembly of any number of connections. Members are riveted to the plastic base. Permanent or temporary short connections may be provided between two or more adjacent terminals.

•

Resistor



Regan bank-type resistor: resistances from 1 to 11.5 ohms per single unit for nickel alloy and 2.2 to 81.0 ohms for nickel chrome alloy. **Techmann Industries, Inc.**, 828 N. Broadway, Milwaukee 2, Wisconsin.

Bank type resistors are available in from 2 to 24 resistors in the bank. Cores, elements, straps and binding posts are said to be available separately. In event of burnout, element is reported as easily replaceable. Glazed Steatite cores are used as element support.

•

Liquid Insulation

"Pib", a water repelling liquid: dielectric strength 4.4 kv. per mil, applied: fire point 16 deg. F; freezing point minus 50 deg. F.; slow drying. **U. S. Industrial Chemicals, Inc.**, 60 E. 42nd St., New York, N. Y.

A liquid which, it is claimed, when applied to water soaked electrical insulation will almost immediately return the insulation to its original value. It is applied by brush or by spray directly on the wetted joint or cable. It is reported as an effective means of water-proofing transformers, and both a.c. and d.c. motors and generators. Additional uses reported are for waterproofing automotive ignition systems and for application batteries to resist corrosion.

•

Decade Unit

Decade unit: provides circuit components for tests. **Harvey-Wells Electronics, Inc.**, Southbridge, Mass.

Unit is said to make available, over a wide range, almost any desired value or combination of values of capacitance, in

Specifying CHANCE ANCHORS gives us a complete line to choose from . . .

System expansion plans should include anchors to fit the conditions

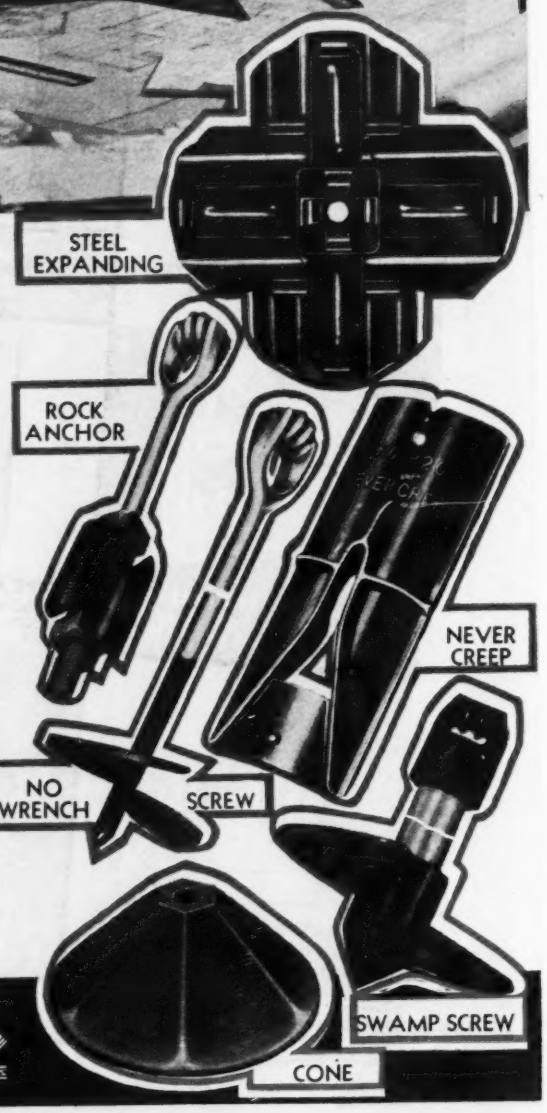
When postwar plans for line extension finally begin to materialize, there ill be Chance Anchors available to meet the most exacting specifications.

To insure the greatest protection for investments in new construction, to et the most efficient anchoring under all soil and guying conditions, plan to ake anchor selections from this—the most complete line. Standardize wher- ver possible, of course, but bear in mind that one anchor just won't do the ob as it should be done under all conditions. That's why Chance Anchors re made in so many types and sizes. That's why it pays to specify Chance nchors in order to meet any and all requirements.

Here are a few of the most prominent types. There are several others and any sizes. Where soil and guying conditions are known factors, definite nchor selections can be written into your specifications now. Your Chance atalog of Pole Line Equipment, the Chance Guy Calculators (available on equest) will help you in making these selections. If possible, plan ahead nd place your order for future delivery. If your need is immediate, perhaps he anchors can be supplied by your Electrical Jobber now.

Thousands of these anchors are delivered daily to the Signal Corps and ther branches of the armed forces, throughout the world. Most of our pro- uction is booked months ahead, but come the postwar period, we'll be all eared up to help you carry out your postwar construction plans.

BUILD SECURITY INTO YOUR LINES

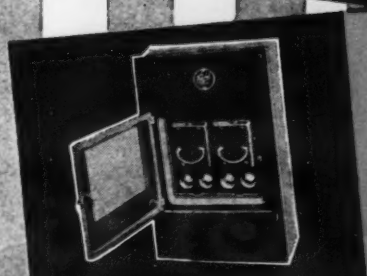


A·B·CHANCE CO.
CENTRALIA, MISSOURI.

HERE ARE SOME OF THE

Federal NOARK ELECTRIC PRODUCTS

FOR THE CONTROL OF LIGHT AND POWER

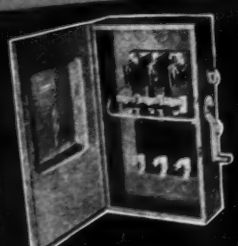


SERVICE EQUIPMENT
All Sequences and Types for the Various Utility Requirements.

INDUSTRIAL CONTROLS
For Motors up to 50 H.P.

CONTACTORS AND RELAYS
From 1 to 100 Amperes.

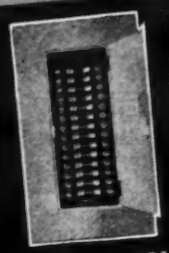
MULTI-BREAKERS
For Home Lighting and Small Motor Circuits. Types MO, M, MB, M1, M2



SAFETY SWITCHES
In Types A-C-D from 30 to 1200 Amperes Single and Double Throw.

TYPE AB-1 CIRCUIT BREAKERS
For AC and DC Lighting and Power Circuits.

METERING EQUIPMENT
Socket Type and Other Standard Designs of Metering Equipment.



PANELBOARDS
For Light and Power Distribution—Fusable and Circuit Breaker Types.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.

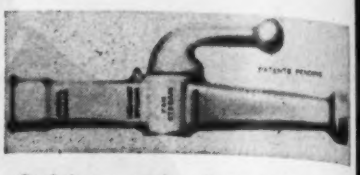
Executive Offices: 30 Paris St., Newark 5, N. J. • Plants: Hartford, Conn., Newark, N. J.

Manufacturers of Motor Controls, Safety Switches, Circuit Breakers, Service Equipment, Panelboards

ductance, resistance, transformer ratios, etc. It is reported that various circuit components may be included in the actual circuits necessary for testing equipment and dissipate resulting heat. It is claimed to save 90 percent of time necessary to connect individual components for test circuits.

•

Fire Nozzle



Dual-stream nozzle. Dugas Division, Associated Chemical Co., Marinette, Wis.

Nozzle is said to permit the operator to apply dry chemical on the fire as a straight stream which has an effective range of 45 ft. or as a fan stream which has a range of 15 ft. Nozzle is reported as approved by Underwriters' Laboratories and by Factory Mutual Laboratories.

•

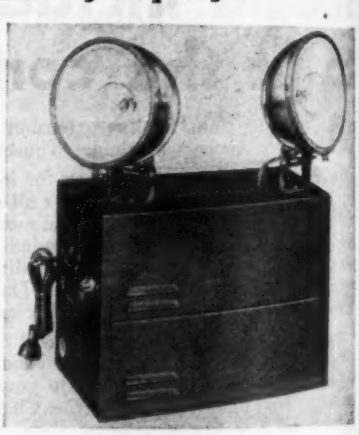
Capacitors

"Hypass" non-resonant capacitor. Sprague Electric Co., North Adams, Mass.

Capacitors are reported as showing no resonance at frequencies as high as 50 megacycles and, in many instances, up to 300 megacycles. As a result, the units are said to be advantageous in filtering or bypassing over wide frequency bands. They are installed as a low-pass filter would be. The two terminals are connected in series with the circuit, and the container is grounded in the usual manner. They may be used to eliminate "hash" in many circuits replacing filters.

•

Emergency Light



"Minuteman" emergency light: Single and double-head types. Electric Cord Co., 50 Church St., New York, 7, N. Y.

Emergency light with built-in battery and charger is said to be adaptable to post, bracket, shelf or platform mounting. Plugs into convenience outlet and automatically cuts battery into circuit when normal power source fails and automatically goes out when power source is restored. Charger is said to automatically cut in and out of circuit as required. Unit is also available with built-in transformer to permit every-day use on normal supply circuits without draining battery.

APR 23 1947

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Save Thousands of Dollars

SEND FOR YOUR COPY TODAY

"Save thousands" is no catch phrase— The rust preventives detailed in this lavishly illustrated, comprehensive, 40-page booklet have helped salvage literally thousands of dollars from the billion-dollar loss each year to *Demon Rust*.

Every man who has anything to do with metals will find this booklet most instructive. Write for free copy to: Shell Oil Co., Inc., 50 West 50th Street, New York 20, N. Y. or 100 Bush Street, San Francisco 6, Calif.

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SHELL RUST PREVENTIVES
...OILS...FLUIDS...COMPOUNDS

KLEIN QUALITY

Safety engineers, purchasing agents and others interested in linemen's equipment can obtain a folder on "Klein-Kord" on request. Write for your copy today.

In the electrical industry—noted for its exacting demands for quality—it is significant that Klein pliers and equipment have remained the standard for more than three-quarters of a century.

And today—as when the first wires were strung—the name Klein still stands first with linemen and electricians who demand reliability plus a high factor of safety in the tools and equipment on which their very lives depend.

ASK YOUR SUPPLIER

Foreign Distributor: **International Standard Electric Corp., New York**

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TECHNICAL LITERATURE

Electrodes—Bulletin, B6344A, is an electrode comparison chart of 22 manufacturers. The eight pages contain information on stainless steel and hard surfacing electrodes, as well as the mild steel type. One section is devoted to a typical weld deposit analysis of stainless steel electrodes, showing the percentages of chromium, nickel, carbon, columbian, and molybdenum. It may be obtained from the Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Adhesives—Copies of booklet on natural and synthetic rubber adhesives may be secured from B. F. Goodrich Co., Akron, Ohio. Contains information on how to select the correct cement for a specific application. Also outlines the differences between the vulcanizing and non-vulcanizing types of rubber cement and contains a table giving data on cement weights, colors and base materials used.

Radio Tubes—1945 catalog and manual on tubes contains 22 pages devoted to tube characteristics, technical information on transmitters, as well as general information and operating notes on thyratron rectifiers. Copies are available from Taylor Tubes, Inc., 2312 Wabansia Ave., Chicago, Ill.

Standards—A.S.T.M. Standards on Steel Piping Materials issued December 1944 is now available from American Society for Testing Materials Headquarters, 260 S. Broad St., Philadelphia 2, Pa. at $2.00 per copy. Compilation is an enlargement of one previously developed in cooperation with the Prime Movers Committee of Edison Electric Institute.

Industrial X-Ray—Booklet describing the uses of 5 to 50 kv. p. units in spot weld control, microradiography, plastics, plywood, hides and leathers, glass, paper, paints, textiles, rubber, gasoline, etc. Copies may be obtained from Picker X-Ray Corp., 300 Fourth Ave., New York 10, N. Y.

Radio—"From One Ham to Another," a book dealing with techniques of reception is obtainable from Panoramic Radio Corp., 242 West 55th St., New York 19, N. Y. It describes the problems that confront the amateur operator and proposes solutions in reducing the number of missed signals, in determining quickly which frequencies are free, and in stepping-up efficiency. Among other subjects treated are choosing a spot in the band, reading signal strength and operation of nets.

Insulating Materials—Bulletin EI44 entitled "Electrical Insulating Materials" covering test data, properties, formulas, graphs, fabrication, design and uses, may be obtained from Continental Diamond Fibre Co., Newark 15, Del. Also contains papers by company engineers on power factor, dielectric constant and loss factor, dielectric strength, insulation resistance, arc resistance, and physical tests. Studies on the influence of water, influence of temperature and influence of frequency are also included.

Radio Licensees—Directory of Emergency Radio Communication Licensees may be obtained from Galvin Mfg. Co., 4545 West Augusta Blvd., Chicago 51, Ill., by request on company stationery. Included are county maps of all states showing station locations and such information as types of equipment, call-letters, output power and frequency.

Santee-Cooper. Glossary of technical and historical facts about the 132,615 hp hydro development along with several hundred photos of the progress of the project are included in this 232-page book obtainable (at $5 per copy) from South Carolina Public Service Authority, 1246 Main Street, Columbia, S. C.

ASBESTOS IN ACTION

K&M EBONIZED ASBESTOS STANDS THE GAFF ON THIS DECK MOUNTED WINCH CONTROL

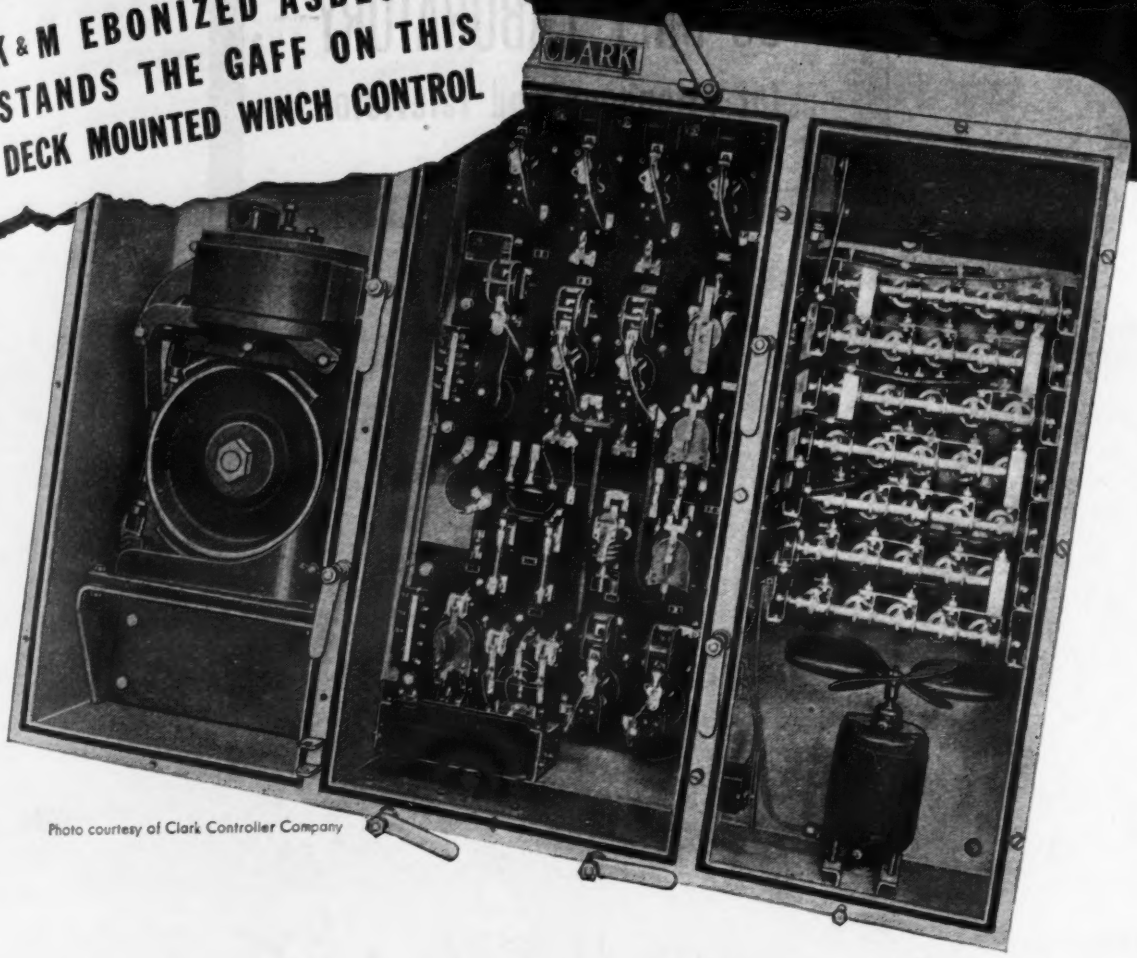


Photo courtesy of Clark Controller Company

HIGH dielectric strength—uniform density—ability to withstand severe shock and vibrations! That's what the panel board on this deck mounted winch control must have. And it has it! It is made of K&M Ebonized Asbestos.

Rapid changes in temperature do not affect K&M Ebonized Asbestos. It does not crack, shrink or bulge. It resists oil and water action. Easy to handle—relatively light—durable. It is ideal for switchboards, bus bar supports, and mountings of all types of electrical instruments, meters, and other apparatus.

K&M Ebonized Asbestos is available for prompt delivery. It comes in a deep black "Panel" or standard finish—⅛" to 4" thick. It is specially developed to meet the requirements of the Underwriters Laboratory, Inc. when built into an assembled unit.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873.

ARMY E NAVY

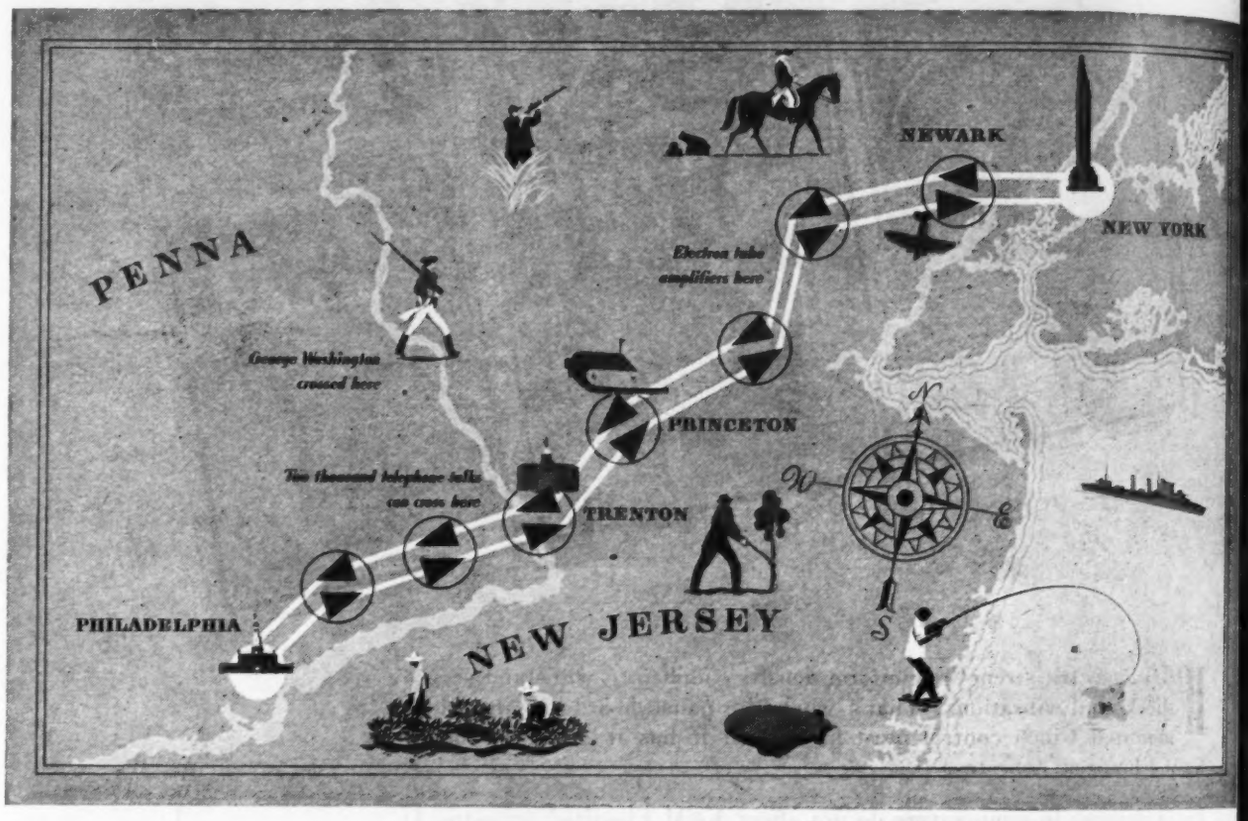
K&M best in asbestos

"Your Merchant Marine saved us during the war — Let it serve you during peace."

KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

90-MILE LABORATORY
for Telephone and Television



BETWEEN telephone offices in New York and Philadelphia once stretched a strange sort of laboratory. Most of the way it was underground; engineers made their measurements sometimes in manholes. It was a lead-sheathed cable containing two "coaxials" – each of them a wire supported in the center of a flexible copper tube the size of a lead pencil.

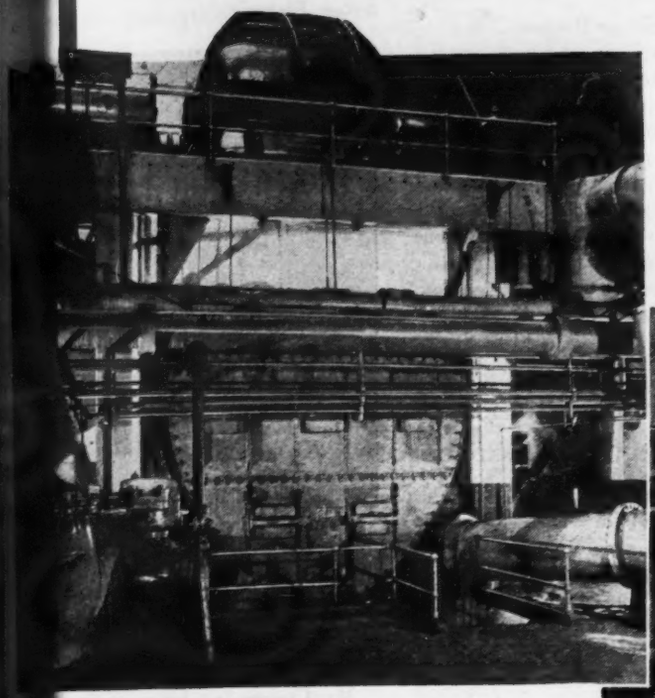
Theory had convinced engineers of Bell Laboratories that a coaxial could carry many more telephone talks than a full-sized voice frequency telephone cable; that it could carry adequately a television program. Experimental lengths were tested; terminal apparatus was designed and tried out. Finally, a full-sized trial was made with a system designed for 480 conversations. It was successful; in one demonstration people talked over a 3800-mile circuit looped back and forth. Now the cable is carrying some of the wartime flood of telephone calls between these two big cities.

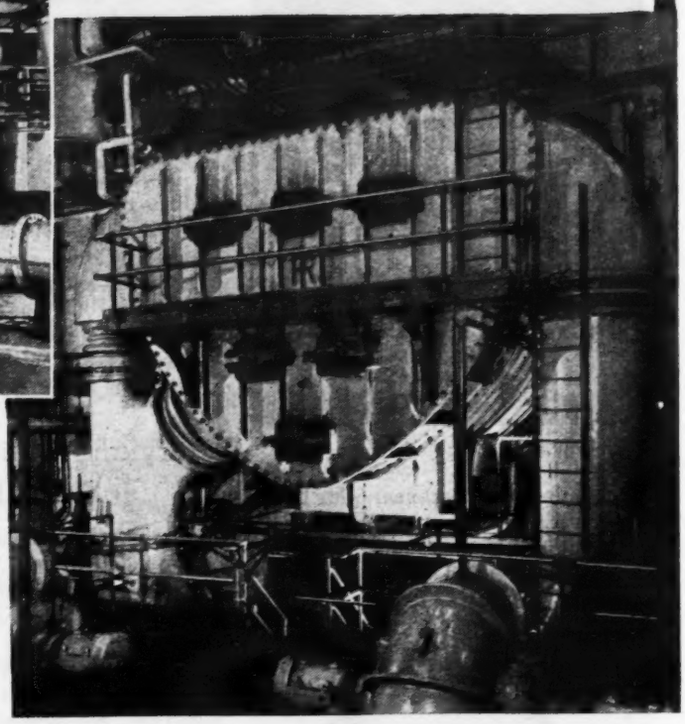
This cable made television history also: through it in 1940 were brought spot news pictures of a political convention in Philadelphia to be broadcast from New York. Bell System contributions to television, which began with transmission from Washington to New York in 1927, have been laid aside for war work. When peace returns, a notable expansion of coaxial circuits is planned for both telephone and television in our Bell System work.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces in war and for continued improvements and economies in telephone service

again--- *Anaconda Tubes* render Outstanding Service





Two condensers at plant of Buffalo Niagara Electric Corporation, equipped with Anaconda Condenser Tubes. Upper unit: Capacity 34,000 sq. ft.—7,282 tubes installed in 1926. Lower unit: Capacity 45,000 sq. ft.—6,850 tubes installed in 1930.

In 1926 and 1930, the condensers illustrated were equipped with a total of over 14,000 Anaconda Condenser Tubes. Except for a few, damaged while cleaning one of the condensers, these tubes are still in service.

This outstanding performance emphasizes the economy of selecting condenser tubes to meet specific conditions. As an aid to such selection, The American Brass Company offers a two-fold service: First, technical assistance based on years of study of tube metallurgy under a wide range of operating conditions. Second, a wide variety of specialized condenser tube alloys.

As a step toward taking advantage of this service, write today for illustrated Publication B-2, "Anaconda Tubes and Plates for Condensers and Heat Exchangers." 45124

Keep Faith With Your Fighters and Yourself! Buy War Bonds

ANACONDA

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

NEWS ABOUT PEOPLE

Puget Power Announces Executive Appointments

Announcement has been made by the Puget Sound Power & Light Co. of the election of L. A. Williams, formerly executive assistant, to the position of a vice-president and of the formation of

L. A. Williams

a general sales department with Henry R. Kruse, formerly manager of the economic development and research department, as general sales manager.

During his association with the

H. R. Kruse

Seattle utility, Mr. Williams has held the positions of sales promotion manager, district manager (Everett) and executive assistant to the president.

In commenting on the new department, Frank McLaughlin, president of the company, said: "We plan to be helpful to industry in adjusting its operations to a peace-time basis, in getting new industries and in finding markets for new products which this area can produce at low cost because of its economic advantages and splendid resources among which cheap electricity is important."

•

Ebasco Services Promotes Wescott and Gardner

Ebasco Services Inc., service subsidiary of Electric Bond & Share Co., has announced the appointment of T. C. Wescott as executive vice-president and F. C. Gardner as vice-president in charge of engineering and construction succeeding Mr. Wescott.

•

Maryland Utility Group Elects New Officers

At the recent annual meeting of the Maryland Utilities Association Henry S. Davis, general manager of the Conowingo Power Co., Elkton, was elected president.

Other officers included: vice-president, Otis H. Ritenour, Washington Gas Light Co., Washington, D. C.; treasurer, J. Carl Fisher, Consolidated Gas Electri Light & Power Co. of Baltimore and secretary, Raymond C. Brehaut, Washington Gas Light Co.

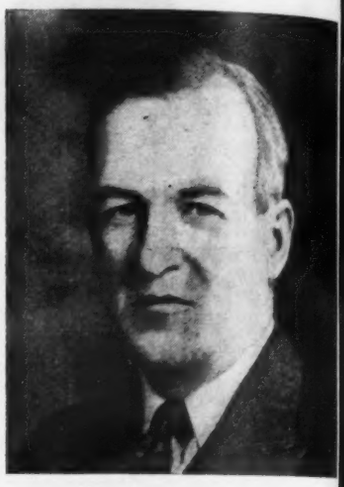
•

► PHILIP J. SAVAGE, vice-president of the Detroit Edison Co., has asked to be relieved from active duty after completing 35 years of service with the company. For many years he has had executive responsibility for the company's lines, transportation, employment, medical and labor relations policies. Employment, medical, personnel and safety work of the company will hereafter be directed by Sylvester F. Leahy, who has been made director of employee relations.

Canadian Manufacturers Elect A. B. Cooper Head

Ashton B. Cooper, who was recently elected president of the Canadian Electrical Manufacturers Association, is president and general manager of Ferranti Electric Limited, Mount Dennis, Ont.

Mr. Cooper's early connections were with the General Electric Co., Westinghouse Electric Corp. and with the Rio



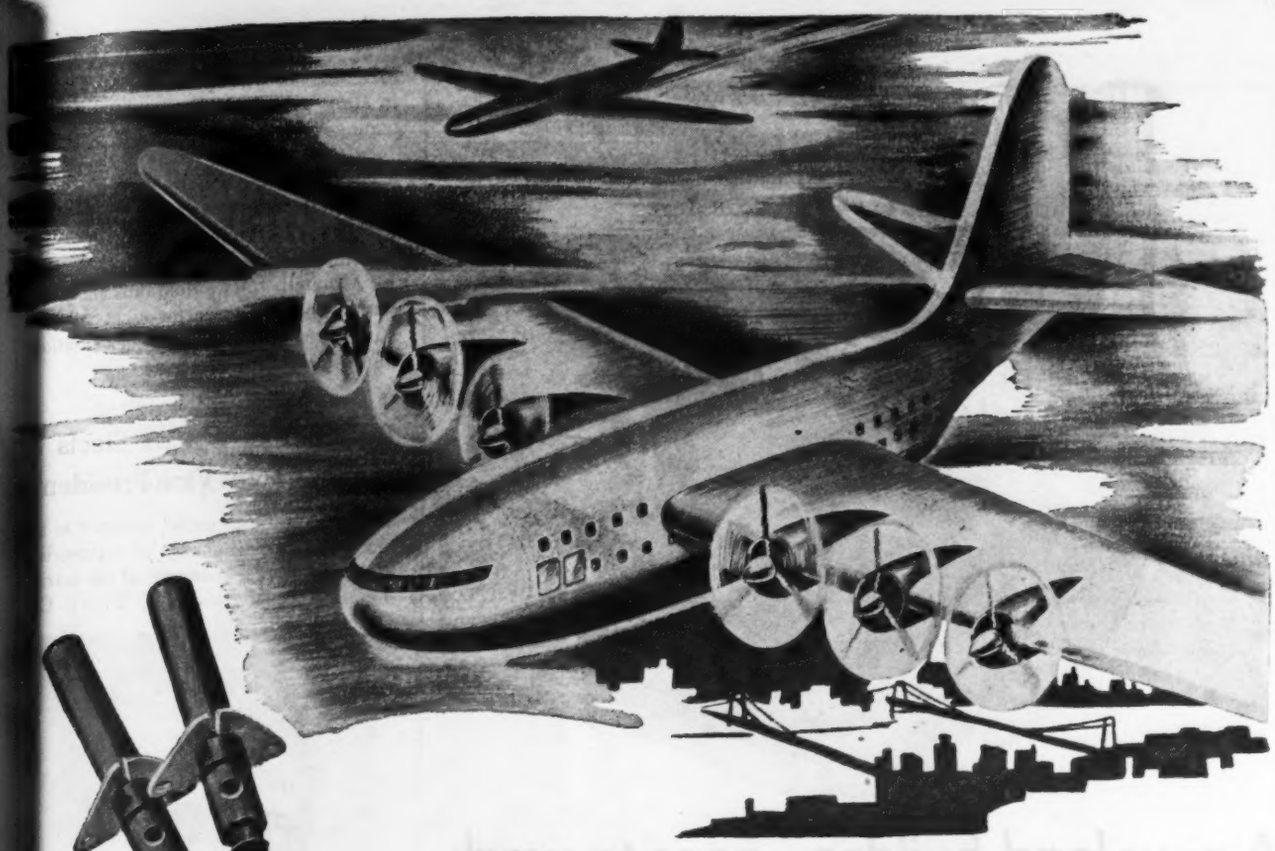
de Janeiro Light & Power Co. In 1913 he became transformer sales engineer for Canadian G. E. Co. in Toronto, relinquishing that position in 1922, when he was appointed general manager of Ferranti Electric.

Mr. Cooper is a fellow of the American Institute of Electrical Engineers, is active in the Canadian Manufacturers Association and is a member of the Engineering Institute of Canada.

•

► WILLIAM B. TIPPY, formerly assistant to the division manager of the Pontiac division of Consumers Power Co., has joined the New York staff of the Commonwealth & Southern Corp., to assist Vice-President J. A. Brown in connection with the operations of Consumers Power Co., Central Illinois Light Co. and Southern Indiana Gas & Electric Co. Mr. Tippy has been identified with Consumers Power Co. since 1936.

► JOHN L. ENRIGHT has been appointed to the position of executive assistant Otter Tail Power Co., Fergus Falls, Minn. In addition to his new duties Mr. Enright will continue to handle franchise negotiations, municipal contracts, etc. J. W. GLASSON, who has been manager of the Jamestown district for the past fifteen years has also been appointed executive assistant. In addition to his other duties he will have charge of a new personnel department which will be set up in the general office



Continental-Diamond
Engineered Dielectric Materials

The DILECTO parts illustrated are insulators in airborne radio equipment. Their insulating properties must remain stable at temperatures from 70° F below zero to 160° F above zero; in high humidity or extreme dryness.

There are 6 C-D Engineered Dielectric materials, each of which provides designers and engineers with a different range of desirable properties. Each of these 6 C-D materials is made in several grades to meet specific electrical and mechanical problems. Our technicians will be glad to help you apply these C-D Dielectrics to your "What Material" problem.

C-D technicians have at their call the accumulated "know how" of 50 years of experience helping customers solve electrical insulating and mechanical problems. Use this wealth of information to help you solve your design and performance problems.

C-D PRODUCTS

The Plastics

DILECTO—A Laminated Phenolic.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

Descriptive Literature

Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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SPARTANBURG, S. C. SALES OFFICES IN PRINCIPAL CITIES

•

WEST COAST REPRESENTATIVES
MARWOOD LTD., SAN FRANCISCO 3

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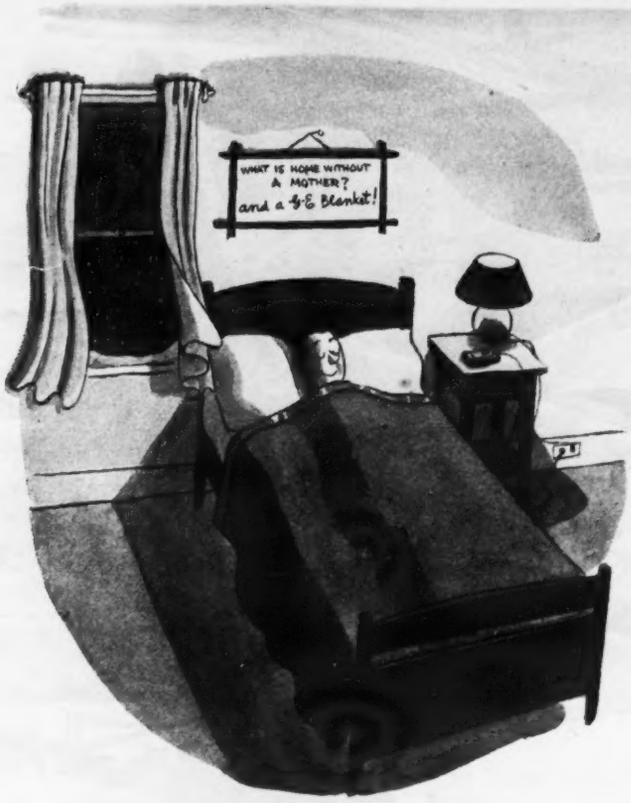
IN CANADA:
DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental-Diamond FIBRE COMPANY

Established 1895.. Manufacturers of Laminated Plastics since 1911—NEWARK 15 • DELAWARE



A new load-builder—goes to work when the lights go out!

There's a new midnight-to-morning load-builder in the offing for you—the new Automatic Blanket made by the General Electric Company.

The G-E Blanket goes to work when the lights *go out*—builds up your load during the darkest hours. Two Automatic Blankets equal one six-foot refrigerator in energy consumption.

Right now, G.E. is making "electrically-warm" flying suits for the Army Air Forces—not G-E Blankets. When blanket production begins again, there will be virtually no reconversion hitch, as both G-E Blankets and G-E Flying Suits are made in the same plant.

Already, a big, factual ad campaign on the G-E Blanket is running in a full list of consumer magazines . . . *Life, This Week, Good Housekeeping, House Beautiful, The Atlantic Monthly,* and *Harper's.* Plus a new and informative Radio Show—"The G-E House Party," on coast-to-coast CBS five days a week.

We shall be glad to supply you with further information. Simply write: General Electric Co., Appliance and Merchandise Division, Bridgeport, Connecticut.

FOR GOOD LISTENING: *Don't miss Art Linkletter, in "The G-E House Party," every afternoon, Monday through Friday, 4 p. m., E.W.T., CBS. "The G-E All-Girl Orchestra," Sunday, 10 p. m., E.W.T., NBC. "The World Today," News, Monday through Friday, 6:45 p. m., E.W.T., CBS.* **FOR FINAL VICTORY—BUY AND HOLD MORE WAR BONDS**

Automatic Blanket

"Goes to work when the lights go out"

GENERAL ELECTRIC

Mr. Glasson will spend part of his time in the general office, continuing as manager of the Jamestown district.

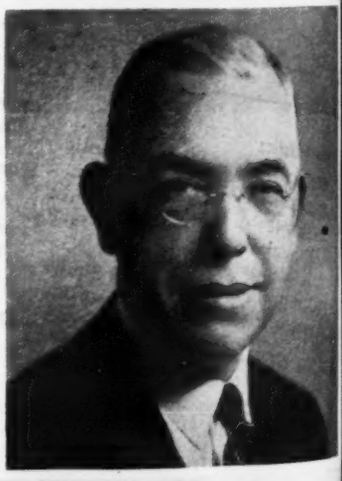
▶ C. B. McManus, formerly assistant operating manager of the Georgia Power Co., Atlanta, has been appointed assistant to the new president, William E. Mitchell. Mr. McManus has been with Georgia Power for eight years as superintendent of district operations and assistant operating manager.

Babcock & Wilcox Elects Two Vice-Presidents

Alfred Iddles, special assistant to the vice-president in charge of engineering, and J. H. King, manager of the marine department, Babcock & Wilcox Co.,

A. Iddles

have been elected vice-presidents of that organization. Mr. Iddles' duties will be extended to include supervision of certain of the company's engineering activities;

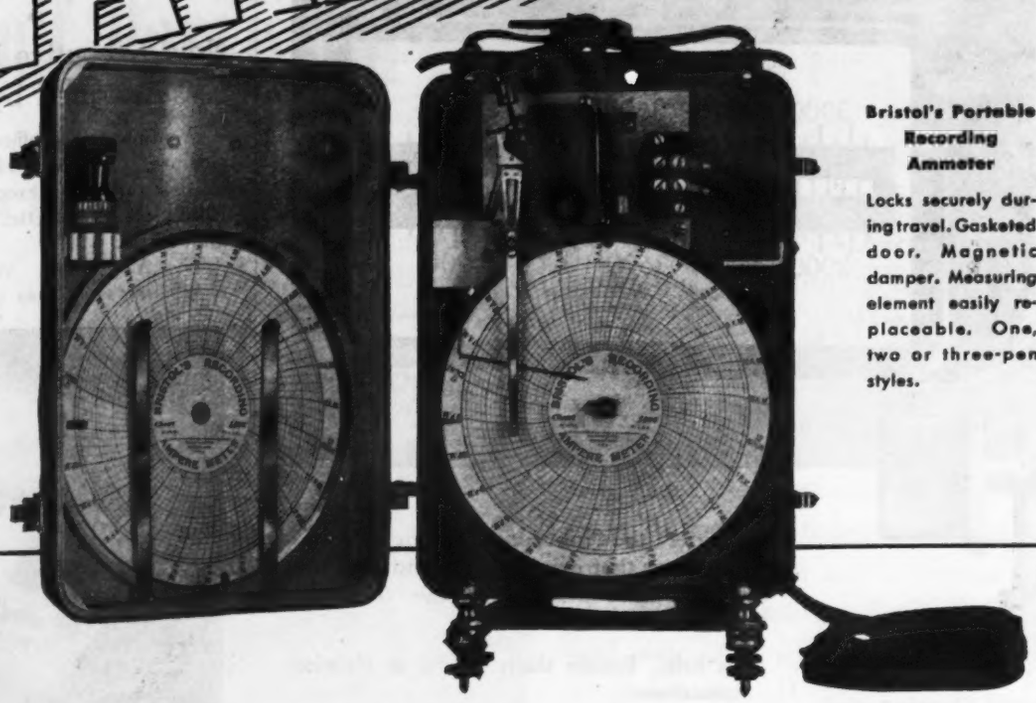


J. H. King

Mr. King will continue as head of the marine department.

Before joining Babcock & Wilcox in 1937, Mr. Iddles was a vice-president of United Engineers & Constructors, Inc.

WARNING



Bristol's Portable Recording Ammeter

Locks securely during travel. Gasketed door. Magnetic damper. Measuring element easily replaceable. One, two or three-pen styles.

YOU'LL STAY A STEP AHEAD OF TROUBLE WHEN YOU USE THIS INSTRUMENT TO RECORD CURRENT FLUCTUATIONS

Bristol's Portable Recording Ammeter will go trouble-shooting with you wherever you go. Hang it on a pole . . . mount it on a wall . . . lower it down a manhole . . . set it on a damp cellar floor . . . it responds instantly and accurately to the slightest fluctuation in current.

Lightweight (17 lbs.), compact, sturdy, Bristol's Portable Ammeter combines convenience with accuracy to give you a constantly reliable picture of what's going on.

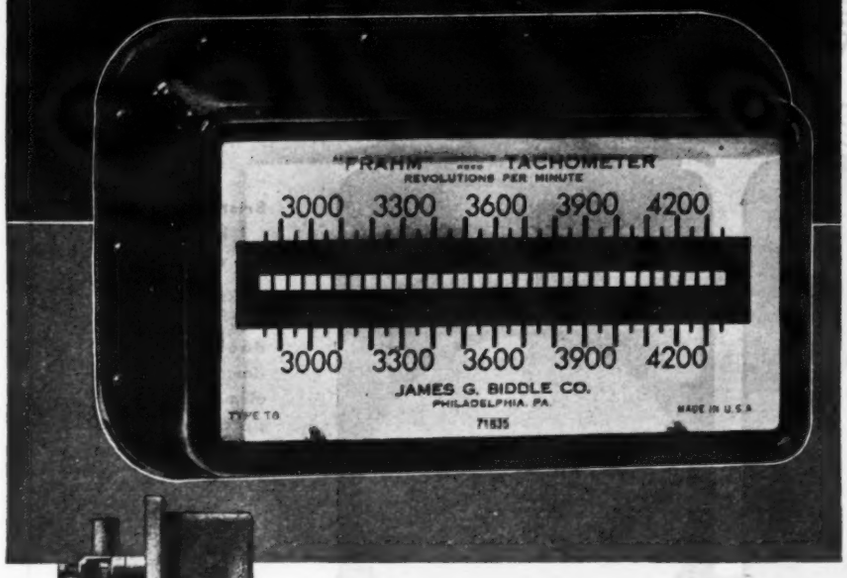
Write for complete facts in Bulletin E1100. Address THE BRISTOL COMPANY, 116 Bristol Road, Waterbury 91, Conn. (The Bristol Company of Canada, Ltd., Toronto, Ontario. Bristol's Instrument Company, Ltd., London, N.W. 10, England). Makers of Metameter, Recording Ammeters and Voltmeters, Thermoverter and a broad line of automatic controlling and recording instruments.

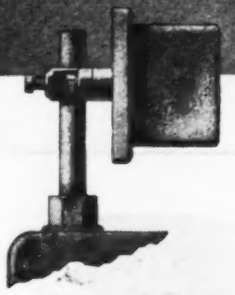
Gives You the Facts when and where you want them

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

THE "FRAHM" VIBRATING REED TACHOMETER...

...is Simple as ABC





Above: Showing one method of mounting the Frahm Tachometer.

Below, left: Frahm Hand Tachometer.

Below, right: Frahm Permanent Mount Tachometer.

Consider the inherent simplicity of a tachometer that need only be mounted on or held in contact with the machine. It means:

No belts, flexible shafts, gears, or electrical connections.

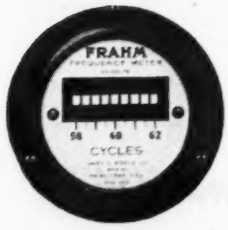
No lubrication required; No maintenance.

Independence from any outside source of power.

And the Frahm Tachometer is as accurate as it is reliable. It functions faithfully without attention year after year because there are no delicate parts—no springs, jeweled bearings, pivots, weights, magnets or connecting wires—nothing except a set of steel reeds, accurately calibrated and suitably mounted.

Furnished in stationary and portable types . . . for use on turbines, generators, motors, blowers, centrifugal pumps, Diesel-electric installations, etc. Various ranges available from 900 to 30,000 r.p.m.

For a complete description of Frahm Tachometers, together with list of types and ranges commonly supplied, write for Bulletin 1590-W.



"FRAHM" VIBRATING-REED FREQUENCY METERS—operate on the same unique principle as Frahm Tachometers, except that reed vibration is produced electrically instead of by direct mechanical contact. Unaffected by wave form or ordinary temperature changes. Switchboard, portable and miniature types in various ranges from 10 to 500 cycles per second. Write for Bulletin 1695-W.

JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

Philadelphia, in charge of design and construction work of all kinds in the United States, Canada and South America. He is a fellow and a past vice-president of the American Society of Mechanical Engineers.

Mr. King has been associated with the company since 1914 and has been manager of the marine department since 1932.

•

New Executive Duties Assigned by Elliott Co.

Creation of the office of engineering vice-president and additional responsibilities for other executive officers of Elliott Co., Jeannette, Pa., have been announced.

W. A. Elliott, vice-president in charge of sales, was elected executive

W. A. Elliott

vice-president. Ronald B. Smith, manager of engineering research and development, was elected vice-president in charge of engineering. M. G. Shevchik, secretary, was elected secretary and

R. B. Smith

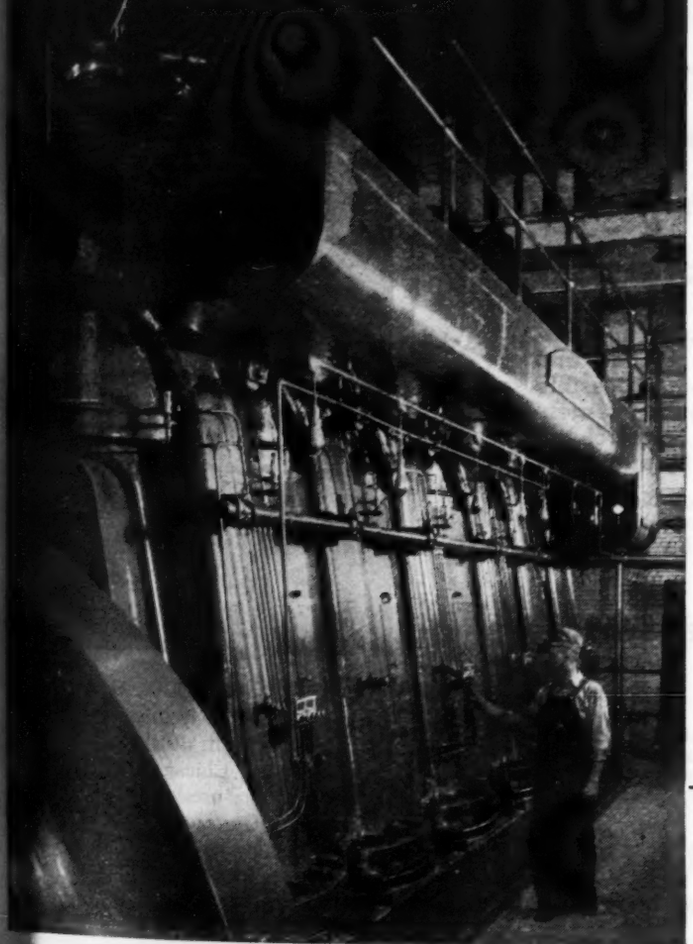
treasurer. F. W. Dohring, general sales manager, was given added re-

Better Lubrication with

Gulf Parvis Oil

means lower maintenance costs!

Gulf Parvis Oil
provides the kind of protection
your Diesels need now



MAINTENANCE COSTS usually tell the story of lubrication efficiency —and the operating records of hundreds of Diesels in industrial and marine service prove that maintenance costs *go down* and *stay down* when Gulf Parvis Oil takes over the lubricating job.

This quality Diesel lubricating oil provides a higher degree of protection to vital parts—helps prevent excessive wear that leads to shutdowns and high maintenance costs. And here's another important plus value you get when you use Gulf Parvis Oil: The helpful counsel of Gulf Service Engineers, *specialists in scientific Diesel engine lubrication.*

Make sure your Diesels are getting the kind of lubrication that helps insure uninterrupted power output and low maintenance costs. Write, wire, or phone your nearest Gulf Office today and ask a Gulf Lubrication Service Engineer to call.

Lubricated with Gulf Parvis Oil, this Diesel has delivered dependable, low-cost service for 18 years—no operating troubles, no repairs to lubricated parts during this period.

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DIVISION SALES OFFICES:
Boston · New York · Philadelphia · Pittsburgh · Atlanta
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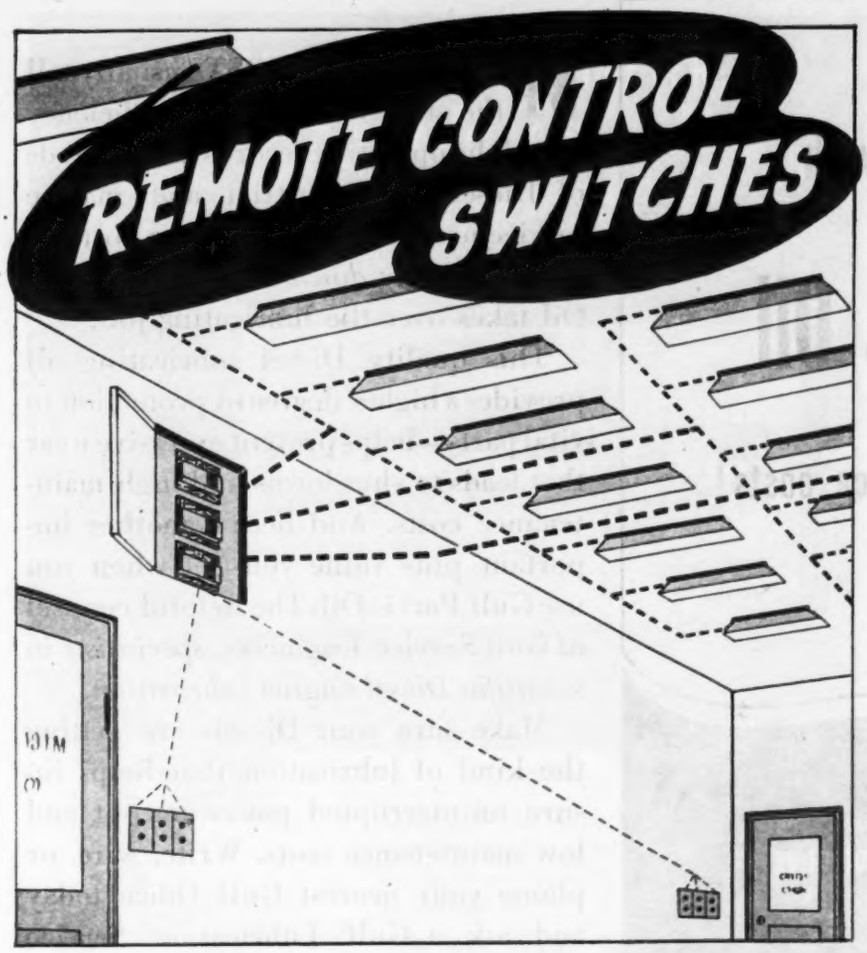
GULF INDUSTRIAL LUBRICATION



PROVIDE

★ *economy in wiring*
★ *convenience of control*
★ *greater design flexibility*
★ *less line drop and loss*

"Type RC" Remote Control Switch is widely used in industry for the control of interior and exterior lighting and floodlighting. It provides remote control from accessible switches. Feeders are run directly to distribution centers so located as to provide short branch circuits. Control stations at desired remote points are connected by pilot wire.

If you are working on a lighting or power load problem, check with our engineers on the advantages of remote control. We manufacture electrically operated — mechanically held switches and magnetically held contactors and relays.

ASCO Electrically Operated SWITCHES

AUTOMATIC TRANSFER SWITCHES
REMOTE CONTROL SWITCHES
CONTACTORS • RELAYS

We also manufacture a complete line of Solenoid Operated Valves for Automatic and Remote Control of Liquids and Gases.

Automatic Switch Co. 8-AS-3

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sponsibilities as assistant to the executive vice-president.

Mr. Elliott entered the Ridgway plant of Elliott Co. following graduation from Penn State in 1928. He spent two years in motor and generator design, followed by ten years of sales work in the company's Atlanta, New York, Cincinnati and Chicago offices. In 1941 he was made vice-president in charge of governmental relations and became sales vice-president in 1943.

Mr. Smith has been associated with the Elliott organization since 1937. As director of research and development, he has devoted considerable attention to the design and construction of gas turbine power units. Jointly with Professor C. Richard Soderberg, Mr. Smith in 1943 was awarded the Captain John H. Linnard prize for the best technical paper contributed to the Society of Naval Architects and Marine Engineers, entitled "The Gas Turbine as a Possible Marine Prime Mover." He has served on the A.S.M.E. power test codes committee, the coordinating committee on gas turbines and the committee on industrial instruments and regulators. In his new executive position, Mr. Smith will continue to direct the Elliott Co. research activities.

•

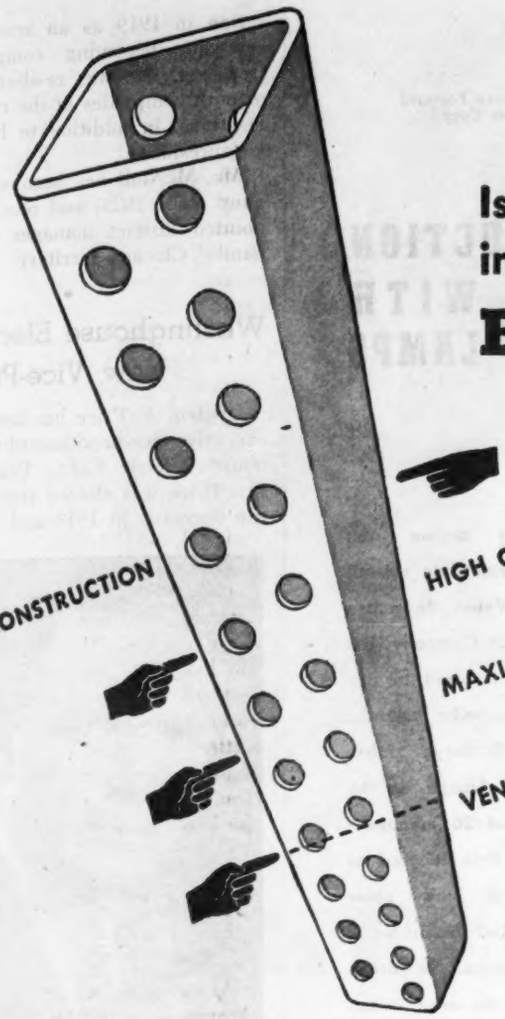
Okonite Co. Elects Two New Vice-Presidents

At the recent annual meetings of The Okonite Co. and the Okonite-Callender Cable Co., Inc., A. F. Metz was elected vice-president of both companies and a

A. L. McNeill

member of both executive committees and A. L. McNeill, district manager of the companies' Chicago territory, was appointed a vice-president of both companies. E. J. Garrigan was elected a director of both companies and, in addition, re-appointed vice-president and factory sales manager.

Mr. Metz joined the Okonite organi-


ONE-PIECE CONSTRUCTION
HIGH CURRENT CARRYING CAPACITY
MAXIMUM MECHANICAL STRENGTH IN ALL DIRECTIONS
VENTILATING HOLES (in both top and bottom faces)

Isn't this what you want in a BUS CONDUCTOR?

MAXIMUM mechanical strength at minimum over-all cost — isn't that what you want in a bus conductor?

Then check these features of Chase Ventilated Square Tube: simple one-piece construction... maximum mechanical strength in *all* directions (per pound of copper)... high current carrying capacity... internal cooling by natural convection, through ventilating holes.

There you have it! A simple unit, easy to install, *rigid*, and needing no auxiliary clamping devices, Chase Ventilated Square Tube saves installation time and labor, conserves critical copper, stands up to the job, *efficiently*.

To find out more about Ventilated Square Tube as well as other Chase bus conductor forms, write for electrical handbook. Now is the time to *take* time to plan your new AC bus installations—with experienced Chase engineers.

CHASE

CHASE BRASS & COPPER CO.

— Incorporated —

Waterbury 91, Connecticut

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

ALBANY† ATLANTA† BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON INDIANAPOLIS† KANSAS CITY, MO.† LOS ANGELES MILWAUKEE

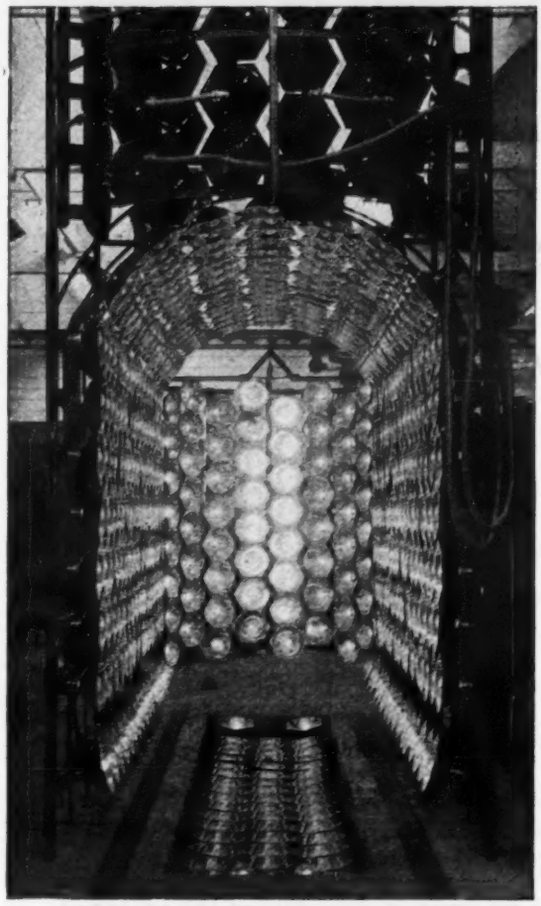
MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WASHINGTON†

†Indicates Sales Office Only

This is the Chase Network—handiest way to buy brass

(Photo courtesy Fostoria Pressed Steel Corp.)

WAR PLANT *DOUBLES* PRODUCTION OF DRYING DEPARTMENT WITH WABASH-BIRDSEYE INFRA-RED LAMPS



This big drying unit (shown with gate raised) in the Weber Showcase and Fixture Company, Los Angeles, is used to dry paint on metallic life rafts. Wabash-Birdseye Infra-Red Heat Lamps do the job in just 20 minutes—half the time it used to take with the older method. And the drying is more uniform. No areas burned. No area damp. A better job in half the time!

WABASH-BIRDSEYE INFRA-RED HEAT LAMPS are standard for most infra-red tunnels, ovens, and other production line installations. In adapting your equipment to achieve the really dramatic results possible with Infra-Red remember that Infra-Red heating is a science; and, *for maximum efficiency, Wabash-Birdseye Lamps should be used with scientifically engineered equipment.* We will gladly furnish names of manufacturers of such equipment.

WABASH APPLIANCE CORPORATION
345 Carroll Street Brooklyn 31, N. Y.

WABASH-BIRDSEYE
First in INFRA-RED

zation in 1919 as an accountant, successively becoming comptroller and treasurer. He was re-elected treasurer of both companies at the recent annual meetings, in addition to being elected vice-president.

Mr. McNeill has been with the company since 1925, and recently was appointed district manager of the companies' Chicago territory.

•

Westinghouse Elects New Vice-Presidents

Gwilym A. Price has been appointed executive vice-president of the Westinghouse Electric Corp., Pittsburgh, Pa. Mr. Price was elected vice-president of the company in 1943 and his responsi-

G. A. Price

bilities had included settlement of the company's war contracts.

Election of three additional vice-presidents were also announced recently to head the lamp manufacturing

R. C. Stuart

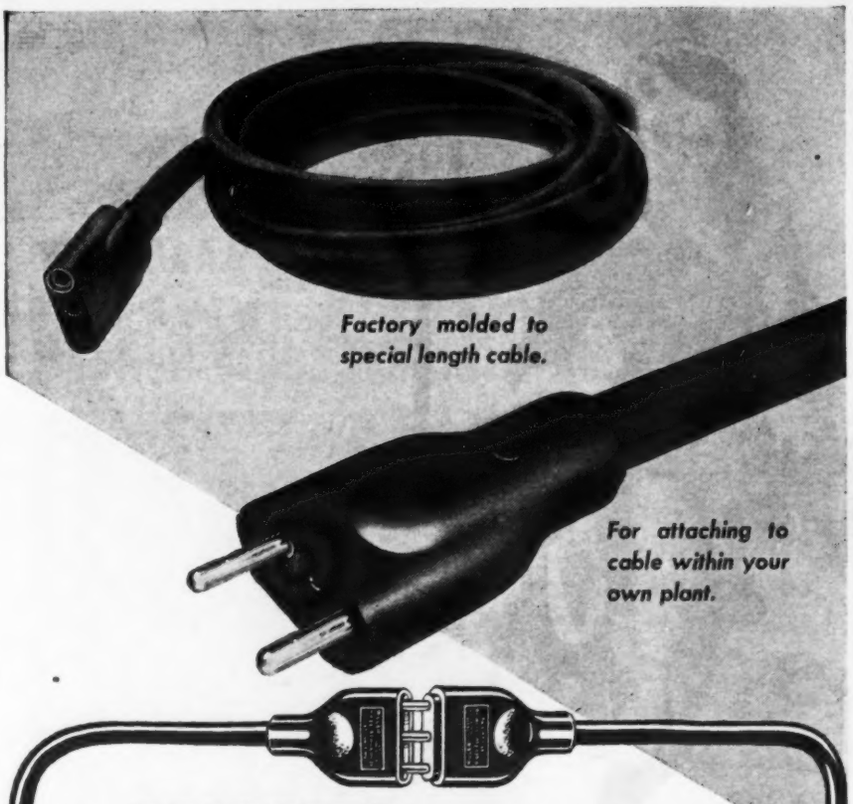
and lighting equipment divisions, the treasury and the law and patents departments. They are Ralph C. Stuart, in charge of the lamp and lighting divi-

TO KEEP GOING

free from needless circuit interruptions and production shutdowns, use Shawmut Shur-Lag Renewable Fuses. They are the simplest and sturdiest renewable fuses made, and the quickest and easiest to renew. Having the least number of parts of any renewable fuse, they are solidly built; they remain in perfect alignment and contact, unaffected by vibration or repeated heating. Shur-lag links are equally unsurpassed in simplicity and effectiveness. You can choose one that will give the longest time-lag of any renewable fuse at the needed critical points. For over 50 years Shawmut fuses have ended fuse troubles. They will end yours now. Use Shur-Lag and be sure.

THE CHASE-SHAWMUT COMPANY **NEWBURYPORT, MASSACHUSETTS**

FUSE MAKERS SINCE 1893



MINES WATER SEAL

RUBBER CONNECTORS Can Be Molded Onto Any Length Cable

Mines Molded Rubber Electric Cable Connectors can be furnished for attachment to cable right within your own plant or they can be molded to longer, special-length cable in our factory.

Mines Connectors, once molded to electric cable, become a part of the cable itself giving a safe, efficient water seal connector.

Our engineers will gladly work with you in solving portable cable applications. Mines Connectors are available in single or multi-conductor, on capacities up to 5000 volts and 325 amperes.

For efficient, safe, flexible electric power transmission by cable, use Mines Connectors—"The Connector with the Water Seal."

WRITE FOR BULLETIN MC-106, ***showing many successful applications of Mines Connectors throughout industry.***

MINES EQUIPMENT COMPANY

4235 Clayton Avenue • St. Louis 10, Missouri

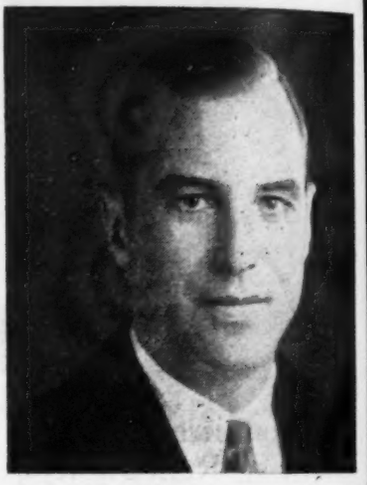
sions; L. H. Lund, who has been treasurer since 1941 and William E. Miller, who had been general attorney in charge of the law and patent department since 1944.

Mr. Stuart will administer the four plants of the Lamp Division at Bloomfield, Belleville and Trenton, N. J., and Fairmont, W. Va., and the Lighting Division's Cleveland, Ohio, plant from the Lamp Division headquarters at Bloomfield. Mr. Lund and Mr. Miller have their offices in Pittsburgh, Pa.

•

General Electric Promotes Nela Park Executives

Three sales executives at General Electric Co.'s Nela Park have been advanced to new positions as part of a reorganization program affecting home office operation of the General Electric



W. H. Robinson, Jr.

Lamp Department. Advanced to positions of greater responsibility are O. H. Young, W. H. Robinson, Jr., and E. D. Stryker.

Mr. Young, who has been sales man-

E. D. Stryker

ager of all photolamp activities, will continue in that capacity. In addition,

APR 23 1947
APR 8 1947

EXIDES ARE POWERED TO MEET EVERY STORAGE BATTERY NEED

Whatever the Central Station's storage battery requirements—closing and tripping switch gear, operating the control bus, supplying current for rectifiers, emergency lighting, etc.—Exides are ready to meet them with the power that efficient performance demands.

Exide makes several types of storage batteries for control bus operation. These batteries have earned the confidence of engineers everywhere, and their widespread use in public utilities and private industries is proof of their dependability, long-life and ease of maintenance. When you buy an Exide, you *Buy* to *Last.*

No matter what your battery problems may be, Exide engineers will be glad to help you solve them.

ARMY E NAVY

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32

Exide Batteries of Canada, Limited, Toronto

"Cables slide easier in ORANGEBURG Conduit —not so much hard pullin'."

THE possibility of cable failure can be minimized with Orangeburg's four-fold protection:

1. Protection from pulling tension . . . because the friction coefficient is *lower* in Orangeburg than in ducts made of other materials, lessening strains caused by cable pulling tension.

2. Protection from cable sheath abrasion . . . because of its smooth bore, Orangeburg reduces the danger of damage to the sheath when cable is pulled into duct.

3. Protection from water infiltration . . . because Orangeburg's impermeable wall gives cables maximum safety from ground water and resulting corrosion.

4. Protection with cable movement . . . because the smooth surface of Orangeburg reduces wear on the sheath as the cable expands and contracts with changing loads.

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Graybar Electric Co. Inc. • *Distributors* • General Electric Supply Corp.

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ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

however, he will assume new duties and responsibilities assigned to him as part of lamp department's eastern sales division activities.

Mr. Robinson, who recently was named sales manager of electric discharge lamps, has now been made manager of the advertising division to succeed the late H. Freeman Barnes. Mr. Robinson has a twenty-year background of lamp and lighting experience. He joined the G. E. street lighting division at Lynn, Mass., in 1925.

Mr. Stryker has been named sales manager of lighting equipment promotion. In his new responsibilities he will continue his activities with fixture manufacturers and take on such other duties and responsibilities as may be assigned to him. Until lately a member of the sales promotion division at Nela Park, Mr. Stryker has been transferred to G. E. Lamp Department's western sales division.

•

Foster Wheeler Elects Two Vice-Presidents

E. R. Goodrich and John E. Kenney have been elected vice-presidents of the Foster Wheeler Corp. Mr. Goodrich has been associated with Foster Wheeler since his graduation from the engineering school of Yale University in 1912. He has been in charge of the turbine division since the formation of Foster Wheeler Corp.

Mr. Kenney also is an engineer, who has long been associated with Foster Wheeler. A graduate of Notre Dame, he joined the Power Specialty Co., which is a part of Foster Wheeler Corp., 23 years ago, and since then has served in many important engineering and sales capacities. He has been director of Western offices with headquarters in Chicago since 1940.

Lee A. Swem has been appointed to the position of assistant to the president. Mr. Swem has been active in the affairs of Foster Wheeler since 1936 and has been its patent counsel in charge of the legal division.

•

▶ B. F. ILSLEY has been appointed manager of General Electric's wire and cable division, entral station divisions. Following his appointment, Mr. Ilsley announced that the wire and cable organization would be divided into two sections, the cable section in Schenectady and the magnet wire section in Fort Wayne. Sales managers of the two newly created sections are J. S. OVERSTREET, cable, and J. J. CURTIN, magnet wire. Both men were assistant managers of sales for the wire and cable division before the organization changes

What?...ETL makes tests other than electrical?

Just look at the spread of such tests: . . . . . .

HATS
CIGARETTES
PLAYING CARDS
POLISH
SHAVE CREAM
WATCHES
RAZOR BLADES
GOLF BALLS
OVERSHOES
EYEGLASSES

in addition to electric razors, etc.

PERFUME
SOAPS
ROUGE
FABRICS
COMBS
MIRRORS
BUTTONS
CREAMS
POWDER
DIAMONDS
STEEL WOOL
SUNBURN OILS
LIPSTICKS

in addition to electrical appliances, etc.

BABY OIL
TALCUM
BLANKETS
RUBBER SHEETING

in addition to electric bottle warmers, etc.

SHADES
CLOTHESPINS
CURTAINS
TOOTH POWDER
DRINKING GLASSES
CLOCKS
FLOORING
COAL
PIPE
TILE
CONCRETE
FURNACES
PAINT
VARNISH

in addition to electric lamps, appliances, radios, cooking, air conditioning, etc.

PAPER
TEXTILES
FELTS
IRON
STEEL
COPPER
BRASS
ALUMINUM
BEARINGS
GAUGES
DYESTUFFS
CONTAINERS
SYNTHETIC RUBBER
ALCOHOL
ALLOYS
BLOWERS
CARBON
FIREBRICK
PLASTICS
CERAMICS
GRAPHITE
LEATHER
MINERALS
SOLDER
THERMOMETERS
METAL COATING
WAXES
TYPEWRITER RIBBONS
ROPE

in addition to electric wiring, lighting, power.

HEADLAMPS
SAFETY GLASS
WINDSHIELD WIPER
SPARK PLUGS
GREASE
SPEEDOMETER

in addition to electric horns, lights, batteries, reflectors, etc.

To enable you to know products by test, you have available the

CHEMICAL
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of

Entrance to 8-story Laboratories Building of E.T.L.

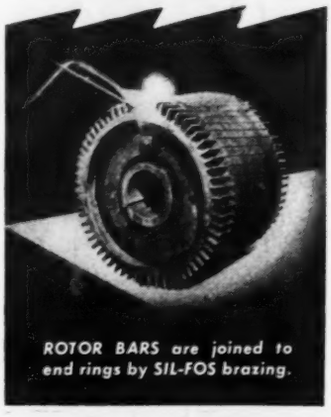
ELECTRICAL TESTING LABORATORIES INC.

2 East End Avenue at 79th St., New York 21, N. Y.

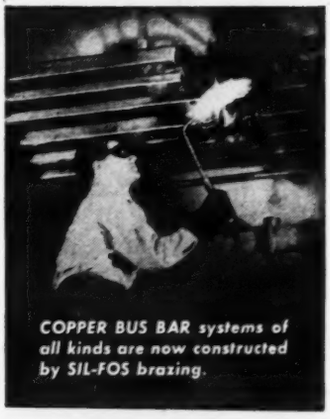
DECK FIXTURE, formerly an aluminum casting, now made by EASY-FLO brazing steel stampings and brass rings.

SWITCH BOX made by EASY-FLO brazing copper and steel outlets to stamped steel box.

The SIL-FOS and EASY-FLO way
is the fast, low-cost way to fabricate ELECTRICAL equipment



ROTOR BARS are joined to end rings by SIL-FOS brazing.



COPPER BUS BAR systems of all kinds are now constructed by SIL-FOS brazing.

Already a wide variety of electrical equipment, such as switch boxes, enclosures, and lighting fixtures, are made by SIL-FOS or EASY-FLO brazed construction. And more and more such parts are being redesigned, or designed from scratch, for this simplified fabricating method.

Naturally, there are compelling reasons for this wide-scale adoption. They boil down to these two basic facts:

1 — SIL-FOS or EASY-FLO brazed assemblies are fully as water-tight, fully as strong, and fully as able to stand vibration, shocks and extremes of temperature as solid metal. They also effectively resist corrosion.

2 — SIL-FOS or EASY-FLO brazed construction is economical — for it can be produced with considerable savings in man-hours, machine-hours, metals and costs.

These are compelling reasons why every designer and producer of electrical equipment should get the facts about SIL-FOS and EASY-FLO, the two low-temperature silver brazing alloys that have made brazed construction practical. You can get them quickly by writing today for

BULLETIN 12-A

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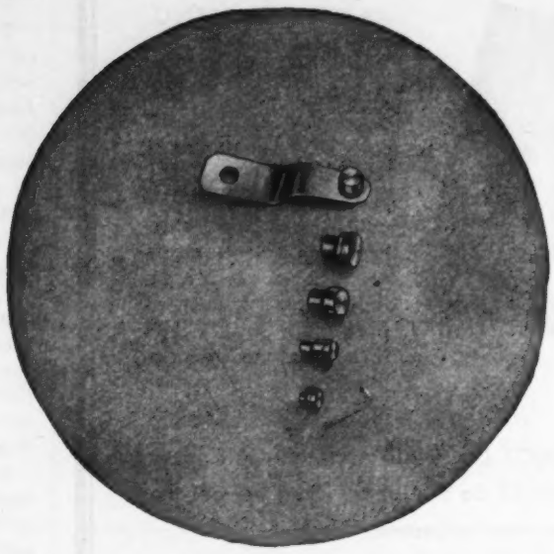
became effective. Mr. Ilsley has been identified with G. E. for sixteen years. He was made general foreman of the wire and cable section in 1930 and became assistant superintendent of the section four years later. In 1937 he was appointed magnet wire specialist of the cable section of the central station department in Schenectady and two years later moved to Fort Wayne. In 1941 Mr. Ilsley returned to Schenectady as general assistant to the division manager of wire and cable. In 1943 he was made assistant manager sales and plant in charge of commercial operations of the Oakland, Calif., cable plant, the position he occupied until his recent promotion.

► M. L. MANNING has been appointed assistant chief engineer of the Kuhlman Electric Co., Bay City, Mich. Mr. Manning was formerly associate professor of electrical engineering and director of the high voltage research laboratory at Cornell University, Ithaca, N. Y. He has ten years of industrial experience which includes motor and generator design work, transformer design and research engineering with the Westinghouse Electric Corp. From 1937 to 1942 he was supervisor of the high voltage laboratories of the transformer division, Sharon, Pa., as well as Westinghouse lecturer in electrical engineering on the staff of the University of Pittsburgh. In 1942 he was appointed associate professor of electrical engineering at the Illinois Institute of Technology, Chicago, and the following year he joined the staff of Cornell University.

► ROY M. SMITH has joined the staff of the Railway and Industrial Engineering Co., Greensburg, Pa., in charge of distribution engineering. Mr. Smith has had a wide experience in the design and development of relay and distribution breakers. He was formerly associated with the Pacific Electric Mfg. Corp. and previous connections included Westinghouse, Bryant Electric and Roller-Smith companies. Mr. Smith is a member of the American Institute of Electrical Engineers, having served for several years on the protective devices committee, and contributed several papers on the application and design of protective relays. He has also contributed articles to ELECTRICAL WORLD and to other technical publications.

► DOUGLAS C. LYNCH, manager of the special projects department of the Westinghouse Electric International Co., has been granted a leave of absence to go to the Philippine Islands where he will serve as technical advisor to President Sergio Osmena on electrical power plant and distribution system restoration problems.

Infinitesimal..



..but essential!

Hardly bigger than a pin-point are some of the contacts and contact assemblies manufactured by Mallory—yet they help to control huge industrial machines.

For more than 22 years, Mallory has developed improved alloys and materials for contacts and assemblies. Today Mallory provides a complete range of contact *materials* . . . silver, platinum, tungsten, Elkonium*, Elkonite* and other special alloys. Mallory engineers have adapted these materials to more than 5000 *designs*, from tiny relay contacts to large contact assemblies for heavy-duty circuit breakers.

Before your equipment designs are blueprinted, it will pay you to consult Mallory. Then you'll be sure to save time and money, with experienced engineering help and the most complete production facilities in the industry. You can readily obtain entire contact assemblies, individual contacts, or contacts assembled to your own studs, springs, arms or brackets.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

**Reg. U. S. Pat. Off. for electric contacting elements.*

3 PLANTS TO SERVE YOU!

At PENN GALVANIZING you have the facilities of 3 plants working 24 hours a day, 7 days a week, to take care of your demands for QUALITY HOT DIP GALVANIZING of your iron and steel products. Furthermore, you are assured of the PENNizing process as perfected by PENN through long experimentation.

When you need QUALITY HOT DIP GALVANIZING in a hurry . . . let the NATION'S LARGEST do the job . . . you will get the long lasting protection at the most economical cost.

HOT DIP GALVANIZING • GALVANIZED IRON AND STEEL PRODUCTS FURNISHED

PENN GALVANIZING CO. *the Nation's Largest*

PICKLING AND PAINTING • PICKLED AND PAINTED IRON AND STEEL PRODUCTS FURNISHED

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Royal-ettes

#13 in a series of informative news letters from a producer of Power Switching Equipment

A DEPENDABLE

MOTOR MECHANISM

When we brought out the Type C Motor Mechanism we didn't expect it to revolutionize the art. But we did build a good device . . . incorporating several ideas that had proven highly desirable from field service and experience:

1. Eight and one-half second duty cycle for disconnect switches, requires lower operating current, smaller feed wires.

2. High-speed, double-break rotary limit switch eliminates contact trouble.

3. Limit switch contacts used for lamp indication in control circuit or for supervisory control through relays.

4. Motor assembly can be changed by removing four cap screws.

5. Provision for automatically disconnecting Motor Mechanism from switch operating mechanism.

Type C Motor Mechanism. For full details, see pages 210-211 of Royal Catalog #10.

ROYAL ELECTRIC MFG. CO. 619 E. 40th Street CHICAGO 15, ILL.

OBITUARY

Dr. William E. Mosher

Dr. William E. Mosher, dean of Syra-cuse University's Maxwell Gradua-School of Citizenship and Public Af-fairs, died of a heart attack on June in Alexandria, Va., where he had been visiting at the home of his son. He wa 67 years of age.

A recognized authority on public uti-ity economy, Dr. Mosher received a three-month leave last year to serve a the budget bureau of the Foreign Eco-nomic Advisory Commission. He was chosen to direct a nation-wide survey electric light and power rates for the Federal Power Commission in 193 when he was given a year's leave of ab-sence from the University.

He collaborated with others in pro-ducing "Electrical Utilities, the Crisi in Public Control," published in 193 and in that same year he was made di-rector of research of the Joint Legisla-tive Commission investigating the pub-lic service commission laws of New Yor State, generally considered one of the most comprehensive surveys of the pol-icies of public service commissions ever made in this country. Dr. Mosher was born in Syracuse, N. Y., and was a graduate of Oberlin College. He joined the staff at Syracuse University in 192

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Livingston D. West

Livingston D. West, vice-president of the Utility Management Corp., New York, from 1929 until he retired, died on May 26 in his sixty-third year.

A graduate of Cornell University, Mr. West was associated with the Cleveland Electric Illuminating Co., the United Electric Light & Power Co., Waterbury, Conn. and the Metropolitan Edison Co., Reading, Pa., and other companies in the General Gas & Electric System be-fore he was made vice-president in charge of sales of the Utility Manage-ment Corp.

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▶ SAMUEL A. SPALDING, vice-president and a director of Gibbs & Hill, Inc., consulting engineers, New York, died at New Canaan, Conn., on May 25 in his seventy-third year. Mr. Spalding was a fellow of the American Institute of Electrical Engineers.

▶ JOHN W. HOWELL, who prior to his retirement was manager of the Jasper branch of the Georgia Power Co. for 17 years, died of a heart attack at his home in that city on May 20. He was 55.

(Advertisement)

SYLVANIA NEWS
CENTRAL STATION EDITION

JUNE *Published by* SYLVANIA ELECTRIC PRODUCTS INC., Salem, Mass. 1945

PUBLIC ENDORSES FLUORESCENT LIGHT

Big Job for Utilities Indicated by Survey

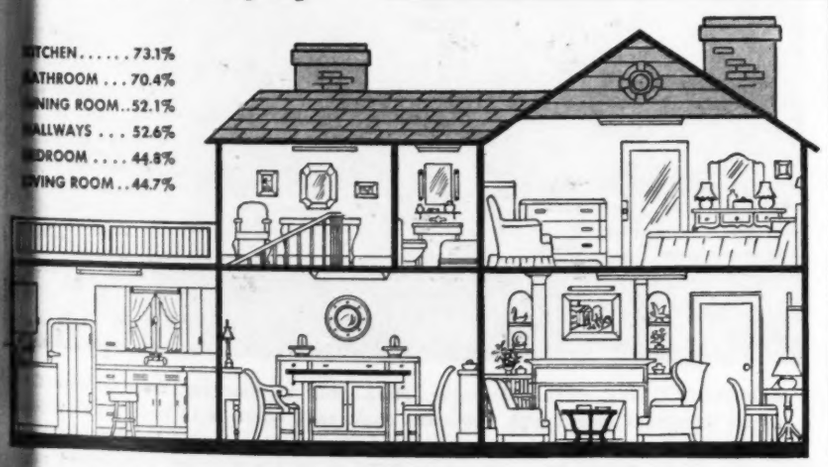
"In what rooms do you think fluorescent lighting is suitable?"

The answer: Kitchen—73.1%, Bathroom—70.4%, Hallways—52.6%, Dining room—52.1%, Bedroom—44.8%, Living room—44.7%.

This was one question asked recently in a nationwide survey conducted by one of the country's leading market research organizations for Sylvania's Sales Research Department.

There is a big job here for the utilities in educating the public to modern domestic lighting techniques. It can be pointed out that, for only a slight increase in the present wattage, the lighting levels in the average home can be almost doubled with the use of fluorescent lamps, and at the same time objectionable brightness factors can be kept to a satisfactory minimum.

Besides, over-the-counter sales of fluorescent lamps will bring additional profits when this new lighting field becomes established. In fact, the construction and remodeling planned by millions of home owners points the way to a vast new era in home lighting.



HIGHER RATINGS SCORED BY 20W AND 40W LAMPS

Chart Shows Increased Operating Efficiency In Popular-Sized Fluorescents

LUMEN OUTPUT OF SYLVANIA FLUORESCENT LAMPS

LAMP	COLOR	Total Lumen Output (after burning for 100 hrs.)		Approx. % of initial lumens/watt at 70% of rated life		
		Previous	New	Rated Avg. Life	Cycling	%LPW
20W-T12	White	860	880	2500	3 Hr.	84
				4000	6 Hr.	76
				6000	12 Hr.	70
40W-T12	White	2100	2160	2500	3 Hr.	84
				4000	6 Hr.	76
				6000	12 Hr.	70

Latest of Sylvania's fluorescent lamp lumen output and efficiency data—for two of their most popular sizes—is contained in the above chart.

This tabulation indicates a more accurate measure (based on indications from field performance) of the high performance that these widely-used T-12 lamps can achieve.

POSITION INDICATORS

Public utilities will note that the 20 and 40 watt sizes are two of the lamps now fitted with position indicators. Molded into the new plastic base featured by Sylvania fluorescents, the indicator tells at the touch of a finger when a lamp is correctly positioned in its fixture.

SYLVANIA ELECTRIC

MAKERS OF FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

MANUFACTURING MARKETS

Admiral Corp. Plans October Delivery

Production of post-war electric refrigerators by Admiral Corp., Chicago, will begin not more than 90 to 120 days after July 1. This was the time figure given recently by L. H. D. Baker vice-president in charge of the company's appliance division.

"Our plans have been in the making for some time and are pretty well laid," Mr. Baker declared. "We definitely will start with a post-war not a pre-war model, one that will remain an integral part of our peace time line," he said.

Mr. Baker said that he is confident Admiral will begin delivery of new units by late October, and possibly earlier, under the War Production Board July "go" signal for the refrigerator industry. The company has already applied to WPB for its manufacturing priority and its third and fourth period quotas.

According to Mr. Baker this Chicago manufacturer has a capacity capable of delivering 300,000 refrigerators in its first full peacetime year.

Admiral Corp. advent in the refrigerator field resulted from its purchase in February 1944 of the Stewart-Warner appliance division. Besides refrigerators, the acquisition embraced home freezers and electric ranges.

•

Announce Change in Sale and Distribution Plan

A major change in the nation-wide sales and distribution of its products has been announced by the Clark Manufacturing Co. of Cleveland, Ohio. Heretofore steam and vacuum traps, pressure regulators, separators, and other steam specialties have been manufactured by Clark and marketed under the name of "Strong Steam Specialties." A change of policy, developed during the past several months and just put into action brings all of the activities of product designing, engineering, manufacturing sales and distribution under the one roof and from now on the company's products will be sold as "Clark Fluid Controls."

W. S. Goff, president, stated that the company henceforth will maintain its individual identity and that it will deal directly with its distributors and customers on a nation-wide scale. He said that the company is devoting its entire effort to war production. Present dealers will serve as the nucleus of a much larger distribution system.

•

Inventions Now Available

The Patent Office has established a Register of Patents Available for Licensing at its Washington office where it is available to the public for inspection. The register includes patented inventions for which the owners are willing to grant licenses on reasonable terms.

80% Rise Predicted In Industrial Use

Post-war industrial use of electric power will be almost 80 percent higher than in pre-war 1939, Charles B. Stainback, manager of the industrial sales department of Westinghouse Electric Corp., stated last week.

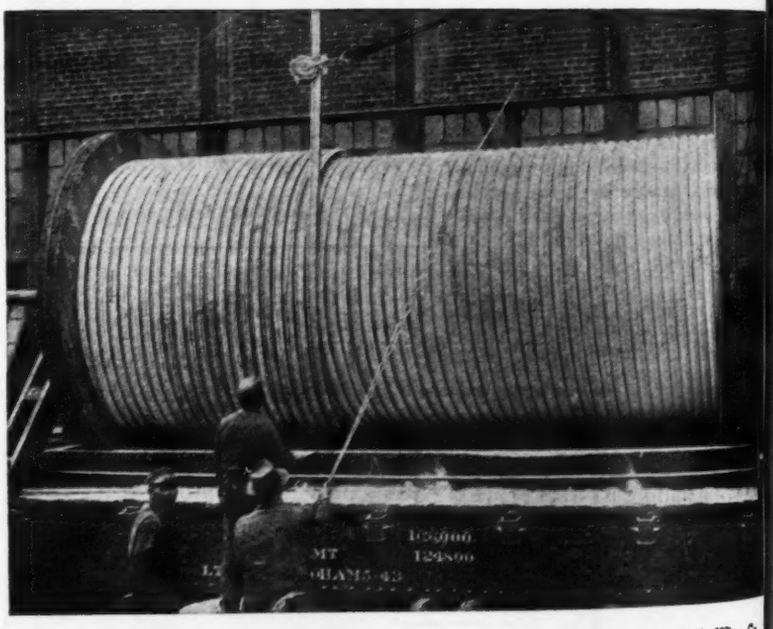
Speaking at a meeting of the Committee for Economic Development, Mr. Stainback said: "We can look for a large decrease in the war-time industrial power consumption of 171,000,000,000 kw.-hr. annually immediately following the war.

"But within one or two years the demand will build up to about 147,000,000,000 kw.-hr. a year, as compared to the 1939 pre-war demand of 82,000,000,000 kw.-hr."

•

Resume Pre-War Output

General Detroit Corp., manufacturer of fire extinguishers and other fire fighting apparatus, has announced that production is being resumed on its pre-war copper finish soda-acid and foam type extinguishers. Discontinued early in the war because of material shortages, Red Star soda-acid and floafoam foam type extinguishers will be available early in July.



MAMMOTH CABLE REEL—Worcester, Mass., mill of American Steel & Wire Co. breaks its plant's record with a wooden cable reel, which is 18 ft. in inside width, 10 ft. in flange diameter, and weighs about 52 tons when loaded for shipment with cradle and blocking. The reel carries 6,500 ft. of 4-inch, 15-kv. ungrounded submarine power cable weighing 11.5 lb. per ft., and composed of 3-conductor, No. 1 strand, having 40 percent Amarine rubber insulation, type "PS" semi-conducting shielding laid up with jute, round wire armor, Marlin serving overall, and of the non-leaded type. Shipment was by wooden cradle on flat car used for loading. The reel was turned over by a removable drive

Silver DEPOSITS ON BUSES AND SWITCH GEAR

INDUSTRIAL BRUSH ELECTRO-PLATING

is the most practical — efficient, and low-cost method of doing this important and necessary work.

This original Brush Process applies the finest plating possible. No experience required. Electrodeposits are placed only where the applicator is applied. This important work can be done safely "on the job" without service interruptions.

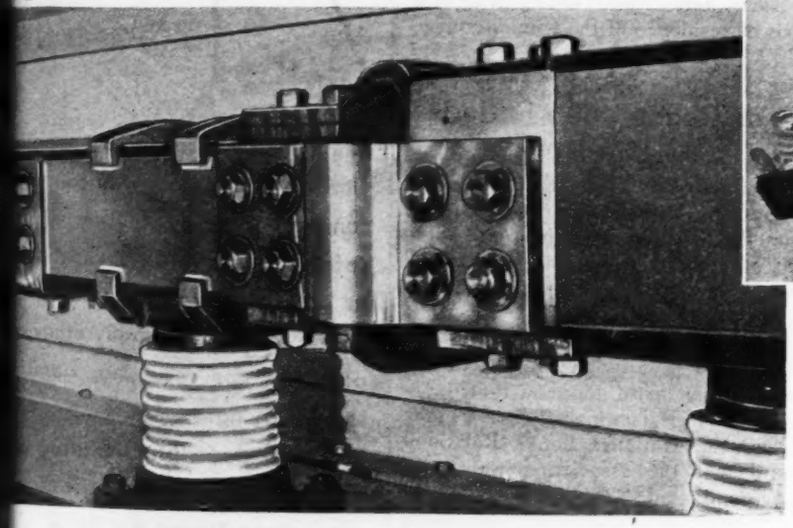
Always ready for instant use—where equipment is installed.

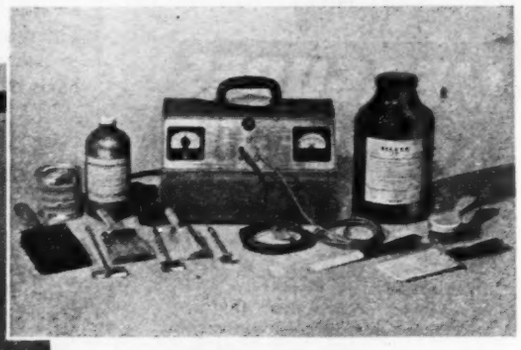
The deposits are 99.9%+ pure silver.

Also applicable for other metals—gold, cadmium, zinc, etc.

- **permit rehabilitation of obsolescent equipment**
- **insure positive protection to strategic metals**
- **eliminate destructive oxidation**
- **give greater electrical conductivity and increased carrying capacity**
- **help prevent loss of power**
- **give longer and more satisfactory performance to present electrical equipment**

Only process of its kind approved and used extensively by U. S. Navy and Army—Aircraft Manufacturers, and most Power Companies.





NEW LOW group price for complete outfit ready for use as illustrated, only $189.50, f.o.b. Chicago. Brushes are made of Nylon bristles and are unaffected by normal plating solutions. They last indefinitely. The power unit, with fittings and supplies pictured, is all you need for this modern electro-plating process.

AJAX-CONSOLIDATED COMPANY

Service to Utilities . . . Industry and Railroads

1415 WEST 20TH STREET • • • • • • • • • CHICAGO 50, ILLINOIS

Safe, even on high voltage lines.

Simple to operate.

Handy Pocket Model for small motors.

MEASURES AC or DC Current INSTANTLY

Instantaneously, by merely "snapping" the tongs around any electrical circuit, you can measure the current — BOTH A.C. and D.C. up to 800 amperes — without necessitating a break in circuit or insulation. Every electrician should have one. It's a time saver — production speeder. Weighs only 2¾ lbs. and is as simple to use as the illustration above suggests. Write today for our TONG TEST Bulletin describing its many time-saving applications.

COLUMBIA ELECTRIC MFG. CO.
4519 Hamilton Ave., N.E., Cleveland 14, O.

COLUMBIA
TONG TEST AMMETERS

Lincoln Foundation Offers $37,500 Welding Awards

A $37,500 award program to encourage investigation, study and scientific development of arc welding in farm operation and maintenance has been announced by the James F. Lincoln Arc Welding Foundation, Cleveland.

The project is intended to enable agricultural producers to develop more fully the arc welding process along scientific lines to widen its utility to the farmer.

Awards will be made for papers describing the application of arc welding to maintenance of farm equipment, machinery or farm structures, including the construction of miscellaneous parts and contrivances. In the paper consideration should be given to such factors as procedures, methods, materials, electrodes, as well as economies of welding; and to type of welding equipment best adapted with suggestions for new equipment and accessories.

The rules for the award have been approved by the Rules Committee headed by Dr. E. E. Dreese, of the Department of Electrical Engineering of Ohio State University.

Participants are divided into two classes, the one for farmers and raisers of livestock, the other for those engaged professionally in agricultural education or services, such as teachers, county agents, soil conservationists, and graduate students in Agricultural colleges. In each division, there will be 131 awards with a first prize of $3,000. Thirty scholarships will also be awarded to state agricultural colleges on the basis of residence of the winners.

•

Union Recognition Ended

Western Electric Co. has notified the Point Breeze (Md.) Employees Association, Inc. that it no longer recognizes the association as the representative of any of its employees. It had been representing workers paid by the hour.

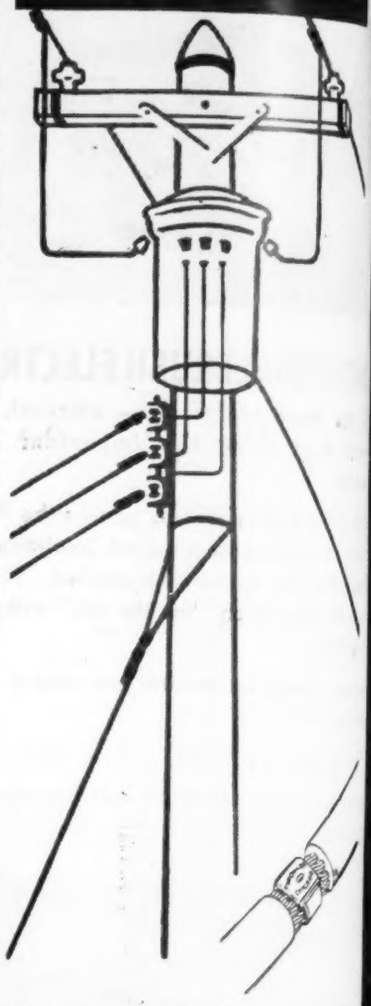
The action followed a refusal of the United States Supreme Court to review a decision of the Fourth Circuit Court of Appeals which upheld a finding of the National Labor Relations Board that the association was company dominated.

•

Borg-Warner to Expand

Borg-Warner Corp. has about completed negotiations for the acquisition of a factory site at Herrin, Ill., where the corporation's Norge Division plans to concentrate all its laundry equipment manufacture.

PUNCH-LOK *Streamlined* Banding and Splicing Method



With Punch-Lok Clamps, applied with the Loking Tool, you can make connections easily, quickly, simply, safely... without taking down wires or installations. Will withstand any normal pull strain. Many other applications for repairing, banding, splicing, tying.

Write for descriptive catalog and name of nearest distributor

Keep Buying War Bonds

PUNCH-LOK COMPANY

Dept. R, 321 N. Justine Street
Chicago 7, Illinois

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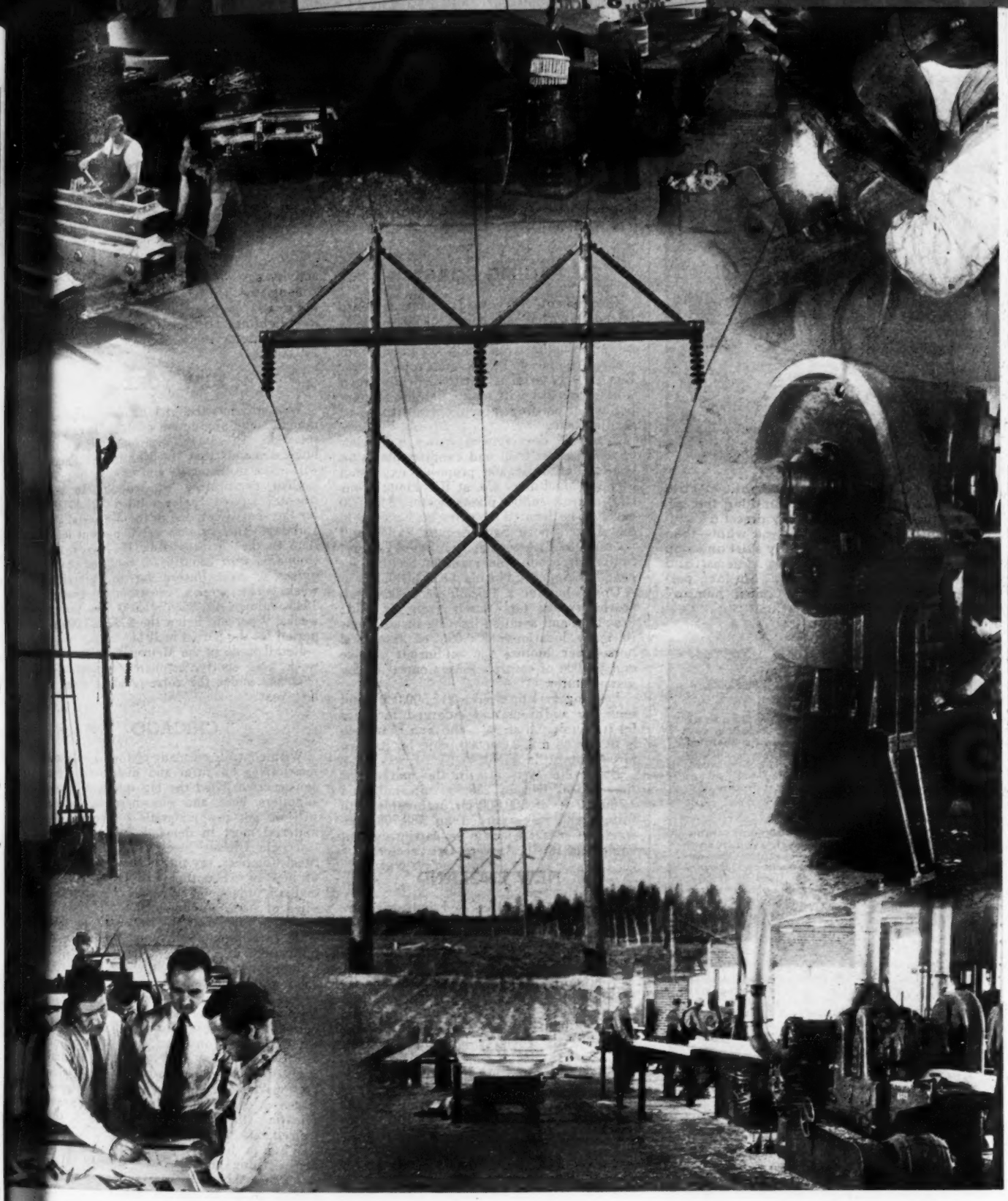


Engineering *Testing* *Seasoning* *Treating* *Wood Working*
Metal Working *Welding* *Galvanizing* *Factory Assembly*

MANUFACTURERS OF

Transmission Line Hardware • Transmission and Distribution Structures • Prefabricated Wood Substations
Special Wood Items • Wood Bayonets • Special Steel Items

Write for Catalog 10

HUGHES BROTHERS

SEWARD NEBRASKA

Write for Bulletin 15

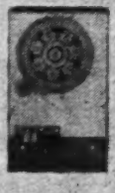
Paragon TIMERS* "TAKE A LOAD OFF YOUR MIND!"

Paragon automatic electric controls go far toward eliminating the fallible human element. Simply preset a Paragon instrument to do what you want—then forget it. It will automatically start and stop machinery, air conditioning systems, and other operating equipment . . . in fact, perform a whole host of "almost human" time control operations.

***A unit for every time control need**

Series 300—General purpose, self-starting synchronous motor operated time switch, self-lubricating, for controlling signs, stokers, blowers, pumps and other purposes. Accurate, rugged.

Series 800—Instantaneous reset, synchronous motor operated, time-delay for motor and tube protection. Used to stagger the closure of multiple circuit systems so that full load will not be applied at start. Has wide application.



Series 700—7-Day synchronous motor operated switch for heating and ventilating systems, lighting and pumping in churches, schools, stores, factories, mines, etc. Can be preset weekly for a weekly schedule. Daily on and off operations may be independently set.

Series 2300—Manually preset interval timer can be preset to perform a great variety of operations: to allow a given operation to continue for almost any predetermined time limit; and to close or open a circuit at the end of the preset time. Synchronous motor operated.

Many other types available. Write today for further information.

PARAGON ELECTRIC COMPANY
703 Old Colony Building, Chicago 5, Illinois

Paragon *Chicago*
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

Field Reports on Business

While controls on many civilian goods have been lifted, material scarcities will limit further volume production. Radar and field communications equipment continue at high levels. An upward trend is noted in store and shop lighting modernization. A large number of commercial refrigeration installations are being planned.

PACIFIC COAST

Government Navy yards, such as Mare Island reported as being 6,000 workers under its ceiling are officially declared to be under-manned in view of greatly increased volume of Pacific area repair work. Electrical material is a critical item of such work, being from its nature subject to combat loss or needing subsequent rewiring and readjustment.

Industrial developments cover a number of dehydration food and canning plants in central California and proposed expansion of Food Machinery Co. at Richmond: four DFC guayule rubber plants, costing $400,000 each, to be located in pairs at Bakersfield and Patterson in San Joaquin Valley and operated by Firestone and proposed General Motor car production plant at South Gate near Los Angeles, costing $1,264,000.

Orders include a $45,935 electrical bomb scoring system for Tucson Army air field; fire alarm and aviation lighting installations in many locations; $30,000 of fractional horsepower motors for oil-burner service and $40,000 of controls for a Central Valley manufacturer.

Los Angeles approved a $12,500,000 bond issue for additions and enlarged facilities for its municipal airport, and San Francisco is to vote on a $20,000,000 issue for its own airport at Mills Field.

Bonneville system is in the market for the 810,000 feet of 250,000 cir. mil. and 1,100,000 ft. of 500,000 cir. mil. cable with fittings and has awarded an $88,708 contract to General Electric for carrier current equipment for its Ampere, Ore., sector.

NEW ENGLAND

New England's diversified industries are not being greatly affected by war contract cancellations and cut-backs as yet, and electrical manufacturing activity, especially in radar and field communication equipment, is continuing at a high level. The possibility of transferring west coast repair jobs to east coast yards is encouraging here and if carried out will sustain the already large movement of wiring supplies and marine equipment to local yards. Last week manufacturers submitted bids to supply the Navy with blowers, ventilating apparatus, sound projection apparatus, small lots of electric cable and wiring supplies. One well-known distributor of arc welders reports an increasing number of inquiries for welders for use in garages and small shops being set up for civilian demands.

A program for extension of rural electrification in towns of western Massachusetts is under way and materials have already been made available to Western Massachusetts Electric Co. for some of the work. Chapman Valve Manufacturing Co., Chicopee, Mass., will purchase the plant now being operated by the company for producing materials for the use of the Navy Department.

Permits for store and shop lighting modernization in Boston issued during the past fortnight show an encouraging upward trend. A number of large commercial refrigeration installations are being planned by engineers who point out promising activity as soon as materials are available. Among the wiring jobs recently appearing in new construction work are wiring for new lighting facilities to be constructed at Massachusetts army camps, at a cost of $90,000.

NEW YORK

War still has the first call on materials, though some production controls have been relaxed. Present indications show the huge demands that the war in the Pacific will make in materials and costs.

Civil engineering construction in continental United States totaled $21,404,000 for the short week due to the Memorial Day Holiday. This volume was 8 percent lower than in the corresponding 1944 week, and compares with $35,016,000 reported to *Engineering News-Record* for the preceding week. The week's construction brought 1945 volume to $685,541,000 for the 22 weeks, 9 percent below the $757,233,000 reported for the period in 1944.

Retail trade in the Metropolitan area last week was spotty, estimates indicating a decrease under the corresponding week of last year.

CHICAGO

With controls off many civilian goods and restrictions on rural and distribution line construction lifted the big question among suppliers here and elsewhere is, "where will we get raw materials"? Steel is the material most in demand, but officials of Carnegie Illinois Steel Corp. and Inland Steel Co., here, say they have no knowledge of how or when they will be able to fill civilian orders. WPB expects larger supplies of steel, aluminum and copper to be available after July 1. But, with the possible exception of aluminum there are no indications of a let-up at the present time.

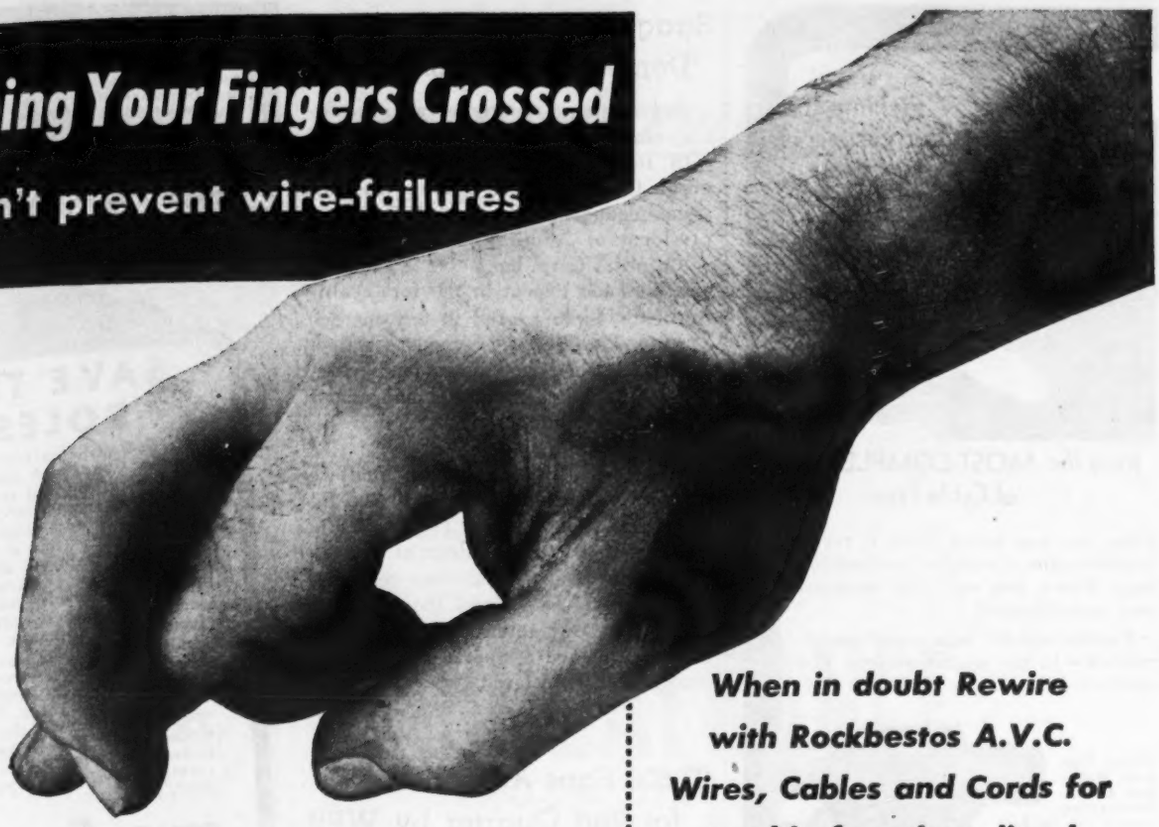
Transformer manufacturers in the Chicago area report that a year's backlog of orders for rural-type distribution transformers, at present rates of production, accumulated "almost overnight" when WPB lifted the ban on rural line construction. Utility orders are said to be only a small part of this backlog which has, for the most part, been built up by REA cooperatives. A shortage of core steel is complicating the problem of reducing this tremendous backlog.

While a few radio tubes, refrigerators and washing machines will appear in retail stores this fall, there will be far from enough to go around. Toasters and metal toys will be on the shelves by Christmas and by the middle of 1946 the consumer outlook will have definitely improved according to government circles which warn that much of the fall production of consumer goods will be earmarked for essential uses. Material scarcities will further limit volume production.

Crosley Corp. has announced a $2,000,000 expansion of its Richmond, Ind., plant where the company's entire refrigerator production will be concentrated in the future. The company's Cincinnati plant will be devoted to radio receiver production, according to the announcement.

Keeping Your Fingers Crossed

won't prevent wire-failures



Do you hope for the best and expect the worst when you think of the war-time beating some of your power, control and lighting circuits have been taking for the past 4 or 5 years? Wiring installed in tough locations when you had to use anything you could get—even though it wasn't built to take overtime abuse under high ambient temperatures or baking overloads?

Then don't wait for trouble! Protect plant operations and production schedules by rewiring circuits that are ready to blow with Rockbestos A.V.C. wires and cables. They are designed to give trouble-free service under severe operating conditions. And they stand up where other wires fail because their *permanent* impregnated asbestos insulation is resistant to heat, flame, oil, grease, moisture, alkalies and corrosive fumes and won't bake brittle, crack, flow, de-center, rot or swell.

Play safe! Put wire-failure insurance into trouble making circuits by installing Rockbestos *permanently insulated* wires, cables and cords. For recommendations, a catalog or samples, write to the nearest district office or New Haven.

ROCKBESTOS PRODUCTS CORPORATION
994 Nicoll Street, New Haven 4, Conn.

FOR VICTORY . . . BUY WAR BONDS

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

When in doubt Rewire with Rockbestos A.V.C. Wires, Cables and Cords for trouble-free, long-lived performance

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated felted asbestos, varnished cambric and asbestos braid. Other constructions for service voltages to 5000.

You can use Rockbestos A.V.C. Power Cable for hot-spot wiring, in conduit or open, around boiler rooms, steam lines, furnaces, etc., and for power leads of heat-exposed electrical equipment as it withstands high temperatures and has ample moisture resistance. Use similarly insulated Rockbestos A.V.C. Motor Lead Cable for motor leads and coil connections.

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE
(National Electrical Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of impregnated asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.

ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors with individuals insulated like Power Cable, cotton braid covered, and cabled with an asbestos braid overall. Standard strandings A.W.G. No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

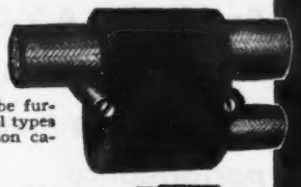
Designed for use in equipment requiring a multi-conductor control cable capable of withstanding high temperatures, this cable is widely used in the control systems of electric cranes and other equipment used in steel mills. The insulation is unaffected by heat, corrosive fumes, oil or grease and has ample moisture resistance.

A few of the 125 different wires and cables developed for severe operating conditions by Rockbestos.

from the MOST COMPLETE lin
of Cable Taps

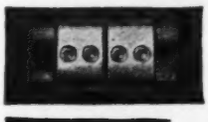
Now you can select from a really *complete* line of standard and special taps. Every one carefully designed and manufactured.

Parallel and 90° taps — and combinations — in the widest variety. For conductor sizes up to 1,000,000 CM.

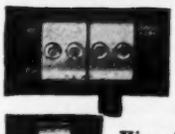


Gutter Tap with Bakelite Cover. Insulating covers can be furnished for all types of Penn-Union cable taps.

2-way Gutter Tap. Main and branch sizes 8 to 1,000,000.



Two Separate Parallel Taps to a continuous main conductor.



Combination Cable Taps; one branch parallel to main, and one at 90°.

Hinged Clamp of Penn-Union Type HFM makes installation easy. Multi-slit tapered sleeve assures permanent grip on branch.

Positive Equalized Pressure on main and branch, with Penn-Union Type SM. Tightening torque is accurate measure of the clamping force.

Also the *most complete line* of Service Connectors — Terminals — and thousands of other fittings, for all requirements.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Siragusa of Admiral Corp. Denies I. T. & T. Co. Merger

Recent press reports of an impending merger of Admiral Corp., Chicago, with International Telephone & Telegraph Co. were categorically denied in a statement issued by Ross D. Siragusa, president of Admiral.

"Admiral Corp. has never in the past and does not expect in the foreseeable future to be interested in any merger of any kind," Mr. Siragusa stated. "Ours has been an independent operation under the present management since its inception, and it is our intention to keep it such."

"It is true," he continued, "that we were approached by officials of the International Telephone & Telegraph Co. who requested the privilege of a meeting at our plant. Discussions resulting never progressed beyond the conversation stage. Our intention to maintain an independent operation is unchanged," he declared.

•

27,500 Fans Authorized for 2nd Quarter by WPB

Production of 27,500 propeller-type electric fans for essential military, hospital, and industrial purposes in the second quarter of 1945 has been assigned to ten manufacturers by the War Production Board. None of the fans will be available for home or office use. Production authorizations in the first quarter totaled 33,565.

The authorized manufacturers and their quotas are Hunter Fan & Ventilating Co., Fulton, N. Y., 8,235; Westinghouse Electric Corp., Springfield, Mass., 7,500; Robbins-Myers Co., Springfield, Ohio, 3,577; Emerson Electric Co., St. Louis, 2,640; General Electric Co., Bridgeport, Conn., 2,338; Signal Electric Co., Menominee, Mich., 2,000; Victor Electric Products Co., Cincinnati, 795; Fresh'nd-Aire Co., Chicago, 250; Diehl Manufacturing Co., Somerville, N. J., 90; Safety Car Heating & Lighting Co., Hamden, Conn., 75.

•

Library Seeks to Expand

The A. F. Davis Welding Library at Ohio State University in Columbus is inviting the assistance of the industry in extending its collection. In accordance with the donor's wish that the Library contain every important book, manuscript, article or document relating to welding, engineers doing original research are invited to send their papers to the Library for permanent filing and for future use by industry.

SAVE THE POLES

• The Sturd-E exclusive Multipoint Cant Hook speeds up pole handling and saves the poles—its six quarter-inch by half-inch points grip much more firmly than a single point—in addition, they do not penetrate the creosote treatment. Result—no deep stab wounds where water collects and rot can start.

Made in three sizes for handling all poles—from the smallest to the big ones 22 inches in diameter. Every utility that has tested the Multipoint Cant Hook has reordered in ever increasing numbers—it saves poles, time, and cost.

STURD E TOOLS
a TRUE TEMPER PRODUCT

MULTIPOINT CANT HOOK
6 points, ¼" x ½" in size grip the pole securely but leave no deep hole to encourage rot and decay. Points renewable when worn. Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.

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BIG *all the way through*

When you see the *new* Ward LaFrance commercial models, you'll be looking at something new in transportation . . . the toughest, sturdiest job on the highway. It's the "civilian" version of the great M1A1 Heavy Wrecker we have been turning out in volume for the Army, developed to be the last word in rugged truck performance . . . The new Ward LaFrance heavy-duty trucks are "built big" not only in rated capacity, but all the way through.

. . . If your fleet suffers from the usual profit-eating toll of axle failures, broken springs, burned clutches, the new Ward LaFrance is the common-sense answer to more dependable, lower-cost hauling. This stamina comes from a basic engineering principle of providing strength, more than sufficient for your requirements. Ward LaFrance has evolved a sales plan of unusual interest, which you should investigate. Write to our Sales Department today for details.

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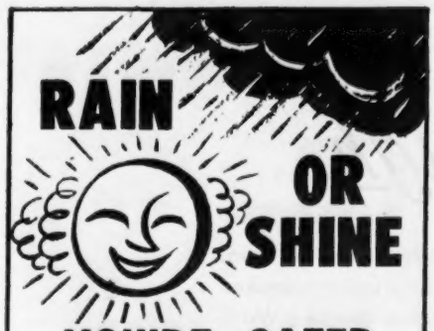
WARD LAFRANCE

TRUCK DIVISION

GREAT AMERICAN INDUSTRIES, INC., ELMIRA, NEW YORK



YOU'RE SAFER WITH SURETY TURN-CUFF LINEMAN'S GLOVES

The Only GLOVE Built on the Petticoat Insulator Principle

Weather worries vanish when you wear Surety Turn-Cuff Linemen's Gloves. You're prepared for fair or foul days, sure of utmost protection, with these patented "petticoat insulator" type gauntlets. Minimize surface creepage with the cuffs turned up in adverse weather, and take two added inches of protection for yourself with the cuffs down in normal conditions.

Surety Gloves are carefully produced; that's why they wear longer, resist snags and abrasion. Every pair is individually tested to exceed safety standards. It's no wonder linemen specify Surety!

THE Surety RUBBER COMPANY
CARROLLTON, OHIO

Sales Opportunities

VIRGINIA—Appalachian Electric Power Co., Roanoke, is arranging an expansion and improvement program in rural electric system, to be carried out over a period of months, totaling in all over 4000 miles of primary and secondary lines, with line transformers, service connections and other facilities.

FLORIDA—War Department, Washington, D. C., has authorized expansion and improvements in MacDill Field air base, Tampa, including additional buildings with electrical equipment, night-lighting system with underground lines, controls and other operating facilities. Entire project will cost about $4,200,000, and will be carried out under direction of U. S. District Engineers Office, Savannah, Ga.

WASHINGTON—Pacific Power & Light Co., Portland, Ore., plans immediate rebuilding of hydroelectric power plant at Naches, recently damaged by fire, with loss reported over $100,000, including equipment. Priority rating is being secured.

PENNSYLVANIA—Rohm & Haas Co., Inc., 222 West Washington Sq., Philadelphia, industrial and other chemical products, will make extensions in plant at Bristol for production for government, including additional buildings, with machinery and electrical equipment for increased capacity of certain war chemicals. Cost about $615,000, with financing by Defense Plant Corporation. Work will begin soon.

SOUTH DAKOTA—Black Hills Power & Light Co., Rapid City, plans new 69,000-volt transmission line from Pluma generating station at Deadwood to Pactola (Pennington County), where new automatic switching station will be located. Also plans rebuilding of present transmission line from Rapid City to Pactola, including reinsulation, etc. Work will be carried out as a post-war development.

GEORGIA—Ford Motor Co., Dearborn, Mich., plans new assembling plant and parts depot at Hapeville, near Atlanta. Tract of about 82 acres of land has been secured. It will consist of a main one-story unit, about 500,000 sq. ft., floor space and several auxiliary units, with machinery and electrical equipment for large capacity, approximating 350 car units per day. A power plant is planned. Project will be carried out as a post-war development, or as soon as materials and equipment are available, and is reported to cost over $8,000,000.

WASHINGTON—Bonneville Power Administration, Portland, Ore., will receive bids until June 19 for 251,100 lin. ft. of 250-MCM copper equivalent conductor and 93 dead-end bodies, 93 jumper terminals, 75 slice sleeves, 60 repair sleeves, and 380 sets of single support armor rod assemblies, delivered at Chehalis; 405,000 lin. ft. of similar conductor and 150 dead-end bodies, 150 jumper terminals, 130 splice sleeves, 90 repair sleeves, 610 rod assemblies, delivered at Olympia; 153,900 lin. ft. similar conductor, 57 dead-end bodies, 57 jumper terminals, 45 splice sleeves, 27 repair sleeves, and 230 sets rod assemblies, delivered at Shelton (Invitation No. 3350). At same time, for 535,000 lin. ft. of 500-MCM copper equivalent conductor, 160 dead-end bodies, 160 jumper terminals, 290 splice sleeves, 25 repair sleeves for the conductor, and 900 sets of single support tapered armor rod, delivered at Bellingham; and

Now—a collective bargaining guide

to save you serious missteps

Here at last is a clear and authoritative new book that meets the increasing demands being made upon you to express your personnel policies and procedures in the rigid and binding terms of written agreements. It shows what management representatives need to know about their own interests and those of employees and unions. It describes the collective-bargaining techniques—and gives the clauses that will best meet the interests of all involved, *without restricting management's logical functions of direction and operation of the business!*

Just Published!

MANAGEMENT AT THE BARGAINING TABLE

By LEE H. HILL
Vice-President, Allis-Chalmers Manufacturing Company

and CHARLES R. HOOK, JR.
Secretary, Rustless Iron and Steel Corporation

McGRAW-HILL INDUSTRIAL ORGANIZATION AND MANAGEMENT SERIES

303 pages, 5¾ x 8¾, $3.00

Read this book yourself—place it in the hands of all in your organization who have to bargain with union or employee representatives or take a hand in the preparation and negotiating of agreements—it will pay dividends many times in excess of its cost.

HERE ARE SOME OF THE HELPS IT GIVES:

—full discussion of all the points of difference that arise in negotiations, showing those upon which it is vital for management to take a firm stand

—many typical clauses from actual agreements, clearly illustrating those which contain pitfalls for management

—practical pointers on preparing for and carrying on negotiations

Whether it is a matter of proper management attitude when disputes reach the War Labor Board or a question of the posting of union notices in the plant—the whole involved matter of seniority, or a question of call-in pay—the problem is covered here with the experienced pointer, the typical clause, the Board ruling, or other fact that will help you.

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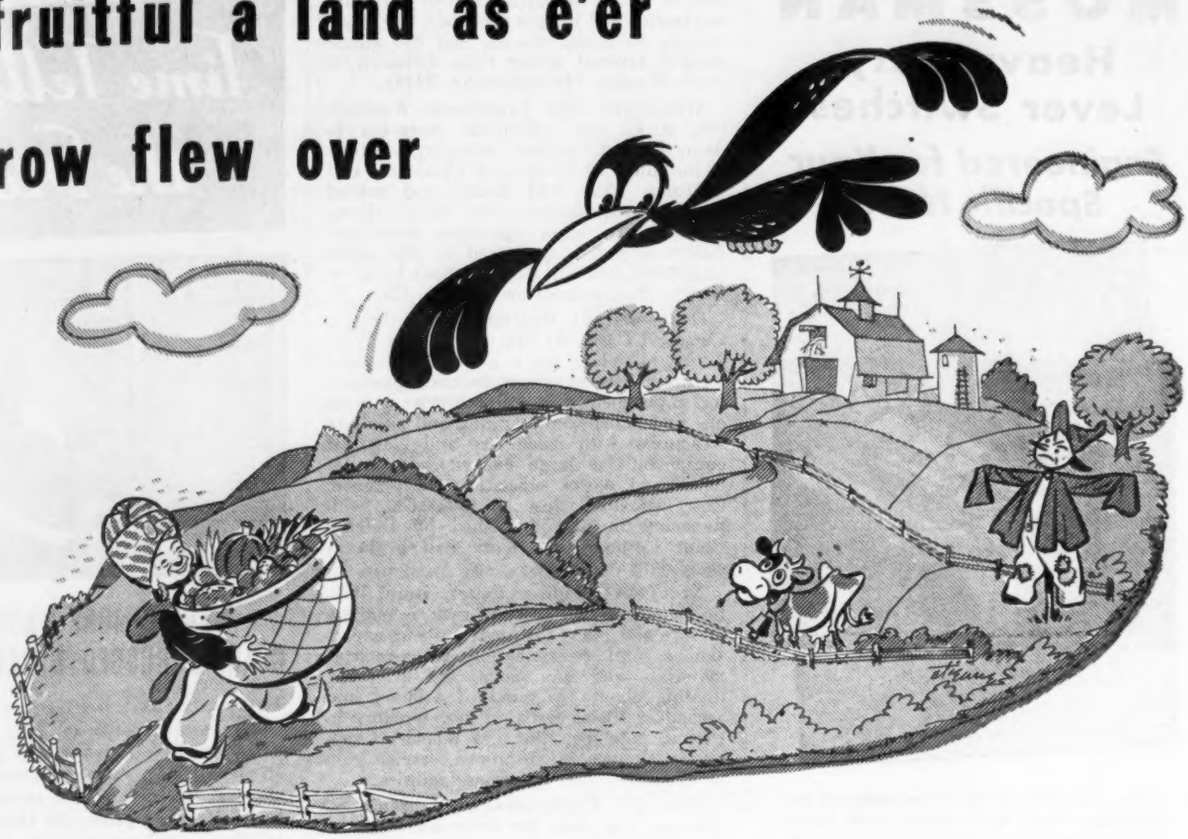
as fruitful a land as e'er a crow flew over



. . . . and not the least of the fruits of India, are its mica and shellac which, for more than 50 years, have been coming to us for conversion into insulations which have kept pace with technological progress. The dependability of Macallen Mica is never jeopardized by heavier "loads" placed upon it.

When you think of MICA think of MACALLEN

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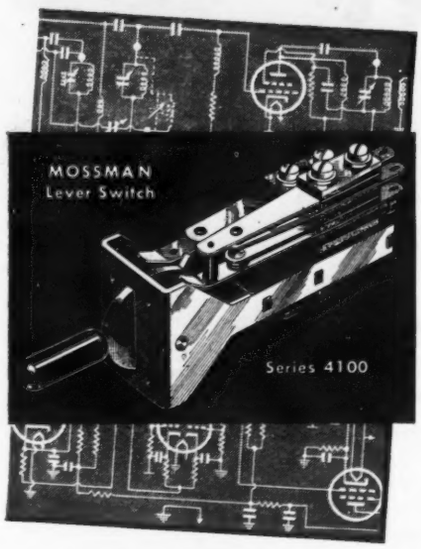
MOSSMAN

Heavy Duty Lever Switches

Engineered for Your Specific Need



Great flexibility of contact elements of the Mossman Series 4100 Heavy Duty Lever Switches makes it possible to engineer just the switch for any definite requirement.

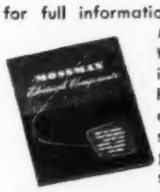
This versatile switch permits interlocking contact arrangements which would be impractical with any other type of switch or plug-in system. Contact springs may be added in combinations as high as 15 springs per pile-up, 30 springs per position, or 60 springs total. Any combination of five basic contact forms allows almost unlimited combinations of contact assemblies.

The Mossman Series 4100 is a rugged, dependable unit with a detent mechanism that jar and vibration cannot throw out of the set position.

Contact Ratings are: Standard heavy duty . . . 3/16" diameter, fine silver, 10 amperes, 110 volts A.C. (non-inductive); Extra heavy duty . . . 5/16" diameter, silver alloy, 20 amperes, 110 volts A.C. (non-inductive.)

SEND FOR THE MOSSMAN CATALOG

for full information on the entire line of Mossman precision electrical components which includes many types of heavy duty, multiple circuit lever switches, turn switches, push switches, plug jacks and special switching components.



DONALD P. MOSSMAN, Inc.
612 North Michigan Avenue
Chicago 11, Illinois

MOSSMAN
Electrical Components

585,000 lin. ft. similar conductor, 170 dead-end bodies, 170 jumper terminals, 220 splice sleeves, 20 repair sleeves, and 850 single support tapered armor rods, delivered to Sedro-Woolley (Invitation No. 3349).

MISSISSIPPI—War Department, Washington, D. C., has authorized expansion in Army Airfield, Gulfport, including additional buildings with electrical equipment and facilities. Also will modify and extend night-lighting system, with feeder lines, controls and other operating apparatus. Entire project is estimated to cost about $4,000,000, and will be supervised by U. S. District Engineers Office, Mobile, Ala.

OHIO—Barrett Division, Allied Dye & Chemical Corp., 40 Rector St., New York, N. Y., has plans for new plant at Ironton for production of certain chemical products for government. It will comprise a main one and multi-story building and auxiliary structures, with machinery and electrical equipment for large capacity. A boiler house and power substation are planned. Cost estimated close to $1,000,000, with financing in part furnished by Defense Plant Corporation. Work will begin at early date.

NEBRASKA—Madison County Rural Public Power District, Battle Creek, is making surveys and plans for large postwar expansion in rural electric system, or as soon as materials and equipment are available, totaling about 725 miles of primary and secondary lines, partly in new territory in Pierce, Antelope, Holt and Wheeler Counties, with power substations, service connections and other operating facilities.

ILLINOIS — Commonwealth Edison Co., Chicago, has plans for extensions and improvements in power substation at 1814 Elston Ave., for increased capacity and will soon award contract for construction work.

COLORADO—Bureau of Reclamation, Denver, will receive bids until June 20 for two 9 ft. by 10 ft. radial gates, with 5-in. dia. rollers, pin bearings, etc., and for two 5000-lb. capacity motor-driven radial gate hoists, for installation in gate structure of Continental Divide tunnel, Colorado-Big Thompson project. Equipment will be installed by government (Specifications 1805).

CALIFORNIA—Public Works Office, U. S. Navy Department, 11th. Naval District, 1220 Pacific Hy., San Diego, is asking bids (no closing date stated) for installation of permanent taxiway lighting system and facilities at Naval Air Station, Holtville (Specification No. 16408); also, bids (no closing date stated) for installation of similar lighting system at Naval Air Station, Camp Kearney, San Diego County (Specification No. 16405).

MINNESOTA—J. R. Clark Co., Second and Aldrich Aves., Minneapolis, manufacturer of metal and wooden products for domestic service, plans new plant at Fridley, where large tract of land has been acquired, comprising two main one-story buildings, 60,000 and 100,000 sq. ft. floor space, respectively, with machinery and electrical equipment for large capacity. Cost about $100,000. application has been made for a priority rating. Magney, Tusler & Setter, Foshay Tower Bldg., Minneapolis, are architects.

•

Leland Sales Increase

Leland Electric Co., Dayton, Ohio, reports net income of $527,094 for 1944, compared with $446,011 in 1943. Net sales totaled $14,272,250, compared with $11,625,855.

Time Tells the Story!

★ 16 YEARS OF SERVICE ★

HERE'S MORE PROOF OF CLARK'S RUGGED DEPENDABILITY

This early Clark heater was installed in 1929, in the home of Mrs. L. E. Dea Sheffield Iowa, and is still in daily use. In outward appearance it resembles only slightly today's Clark models but the basic heating principle that enabled it to give such long, trouble-free service is almost identical with the Clark heater of today. Time and toughest service conditions have only given emphasis to the correctness of its engineering design.

• "GENTLE HEAT"

High temperatures in heating water cause liming, scaling and the freeing of oxygen, all of which are destructive to standard tanks. In the Clark the heat is applied to the water in a wide-area, low-temperature band which entirely eliminates these destructive effects. If heating hard or soft water is a problem in your locality you can depend on the Clark to solve it.

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A CLARK FRANCHISE FOR YOUR TERRITORY MAY STILL BE OPEN. WRITE FOR FULL DETAILS.

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CLARK WATER HEATER DIVISION
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ELECTRIC WATER HEATERS
A Toastmaster Product

Gates — Intake, Sluiceway and Spillway

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Rack Rakes • Trash Racks

Valves — Pipe Line and Penstock

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NEWPORT NEWS, VIRGINIA

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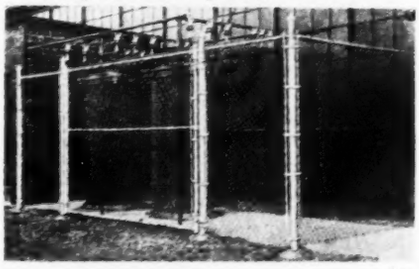
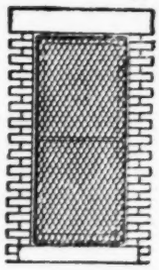
You are assured of complete protection against malicious trespass when you surround property with a Stewart Non-Climbable Chain Link Wire Fence and Entrance Gates. Stewart Fences possess many structural advantages, and are available NOW if your business is essential to the war. Get all the facts about Stewart Fence and other protective products by writing to **The Stewart Iron Works Co., Inc., 1201 Stewart Block, Cincinnati 1, Ohio.**





Wire Window Guards are available now to fit any size or shape opening.

Stewart Partitions are sectional and obtainable now for toolrooms, etc. Steel Folding and Sliding Gates are also available now.

Experts in Metal Fabrications Since 1886

Stewart IRON and WIRE FENCES

REA Allots Funds; Approves Contracts

The Rural Electrification Administration has recently approved allotments totaling $6,943,000 to 66 cooperatives in 20 states and Alaska. Most of these allotments will be used for the extension of electric service to farms located near existing lines.

Included are the following:

ALABAMA—Tombigbee Electric Cooperative, Inc., Sulligent, $125,000; Baldwin County Electric Membership Corp., Robertsdale, $50,000; Clarke-Washington Electric Membership Corp., Jackson, $50,000; Pioneer Electric Cooperative, Inc., Greenville, $50,000; Southern Pine Electric Cooperative, Inc., Brewton, $30,000.

ARKANSAS—Ozarks Rural Electric Cooperative Corp., Fayetteville, $150,000; Ashley-Chicot-Union Electric Cooperative, Inc., Hamburg, $50,000.

FLORIDA—Sweetwater Electric Cooperative, Inc., Sweetwater, $31,000.

INDIANA—Harrison County Rural Electric Membership Corp., Corydon, $75,000; Miami-Cass County Rural Electric Membership Corp., Peru, $15,000 for purchase and rehabilitation of headquarters facilities.

IOWA—Glidden Rural Electric Cooperative, Glidden, $150,000, including $99,000 for purchase of generating plant and $51,000 for installation of an additional 300-kw. generating unit; Humboldt County Rural Electric Cooperative, Humboldt, $150,000; Plymouth Electric Cooperative Assn., LeMars, $150,000; Adams County Cooperative Electric Co., Corning, $100,000; Harrison County Rural Electric Cooperative, Woodbine, $100,000; Nyman Electric Cooperative, Inc., Stanton, $100,000; Cooperative Electric Co., St. Ansgar, $75,000; Monona County Rural Electric Coperative, Onawa, $65,000.

KANSAS—Cooperative Power & Light Co., Inc., Iola, $75,000; C & W Rural Electric Cooperative Assn., Inc., Clay Center, $50,000; Sekan Electric Cooperative Assn., Inc., Girard, $50,000; The D. S. & O. Rural Electric Cooperative Assn., Inc., Solomon, $35,000.

KENTUCKY—Fox Creek Rural Electric Cooperative Corp., Lawrenceburg, $75,000; Harrison County Rural Electric Cooperative Corp., Cynthiana, $60,000; Farmers Rural Electric Cooperative Corp., Glasgow, $50,000; Meade County Rural Electric Cooperative Corp., Brandenburg, $50,000; Nolin Rural Electric Cooperative Corp., Elizabethtown, $50,000; Warren Rural Electric Cooperative Corp., Bowling Green, $50,000; West Kentucky Rural Electric Cooperative Corp., Mayfield, $50,000; Hickman-Fulton Counties Rural Electric Cooperative Corp., Hickman, $15,000.

LOUISIANA—Northeast Louisiana Power Cooperative, Inc., Winnsboro, $50,000.

MICHIGAN—Presque Isle County Electric Cooperative Assn., Onaway, $340,000 for construction of generating facilities.

MINNESOTA—Steele Waseca Cooperative Electric, Owatonna, $218,000; Lake Region Cooperative Electric Assn., Pelican Rapids, $211,000; P.I.C.K. Cooperative Electric Association, Braham, $40,000; Traverse Electric Cooperative, Inc., Wheaton, $10,000.

MISSISSIPPI—Twin County Electric Power Assn., Hollandale, $60,000; Southwest Mississippi Electric Power Assn., Lorman, $55,000; Coahoma Electric Power Assn., Clarksdale, $50,000; Yazoo Valley Electric Power Assn., Yazoo City, $50,000; Pearl

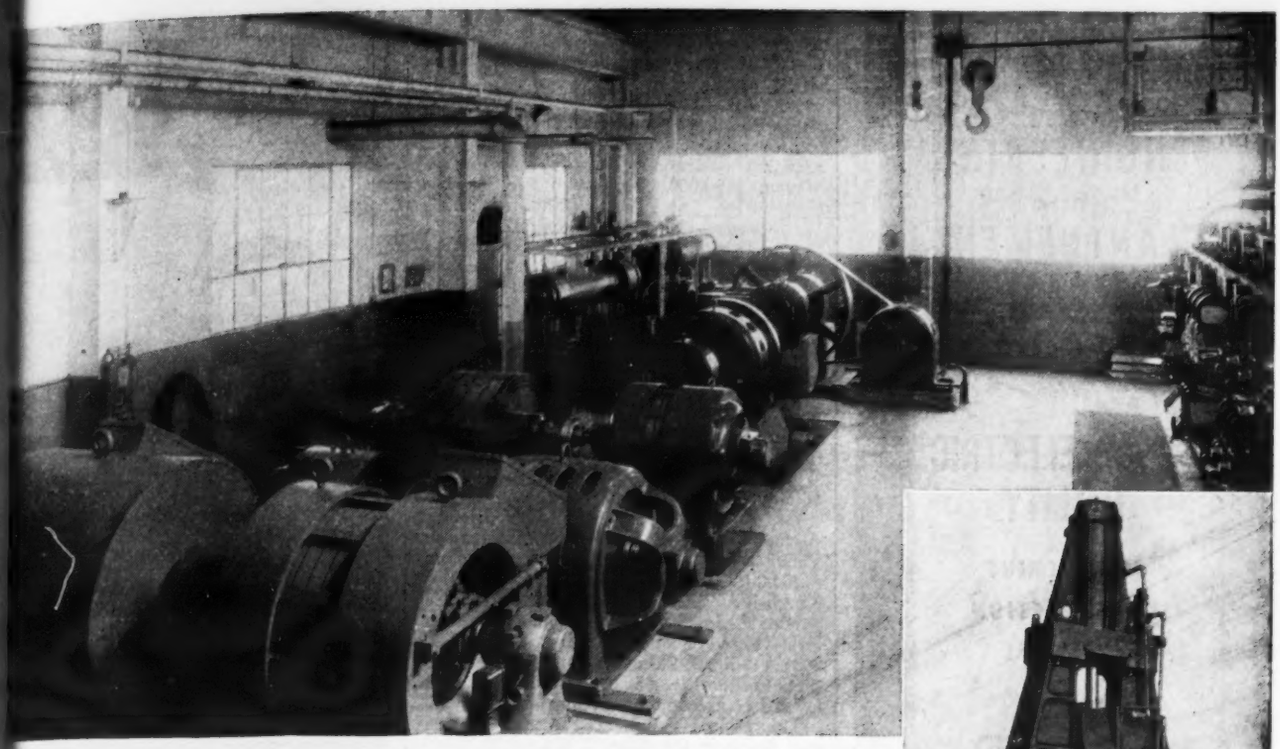
Immediate Shipment on SPLICING SLEEVES

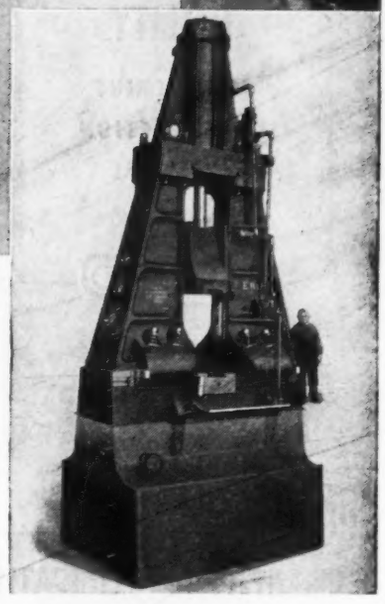
Your requirements in Splicing Sleeves can be supplied PROMPTLY from large, complete stocks which are continuously maintained here.

For many years Sherman Splicing Sleeves have been accepted as standard by the Electric Utility Trade, and the quality and dependability of these sleeves has become generally recognized.

Fill in your sleeve stocks by ordering today from your Sherman wholesaler. We shall welcome your orders, now and in the future—and assure you that every attention will be given to the maintenance of our stocks, as well as the promptness of our shipments.

H. B. Sherman Mfg. Co.
Battle Creek, Michigan





IN THE PLANT OF THE WORLD'S LARGEST BUILDER OF STEAM HAMMERS

BURKE has a *40 Year Record*

ILLUSTRATED ABOVE are shown front to rear the following BURKE UNITS in the plant of the Erie Foundry Company.

For D C Power Requirements:
1—400 K. W. Synchronous M-G Set.
1—200 K. W. " " "
1—150 K. W. " " "

For Driving Air Compressors:
1—100 H. P. Synchronous MOTOR (Direct Drive)
1— 60 H. P. Induction MOTOR (Belt Drive)

For over 40 years, the Erie Foundry Co., world's largest builder of steam hammers, has indicated its approval of Burke Motors and Generators by their long continued use in the power plant pictured above.

For 54 years, Burke has built motors and generators to the specific requirements of industry. This long record of designing for the job, rather than to a compromise standard, has given us a flexibility that continues to prove valuable, wherever *a better than standard* electrical unit is desired.

Burke engineers can assist you in the selection of Burke Motors and Generators that will provide continuous, dependable service. *Write Burke Electric Co., 156 W. 12th St., Erie, Pa.*

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

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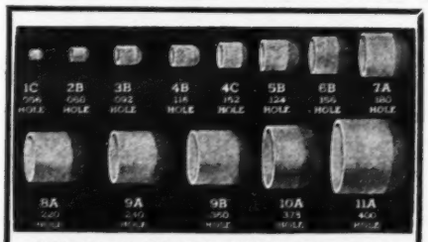

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Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

River Valley Electric Power Assn., Columbia, $10,000 for construction of headquarters facilities.

MISSOURI—Crawford Electric Cooperative, Inc., Bourbon, $212,000; Howard County Electric Cooperative Assn., Fayette, $265,000; Macon Electric Cooperative, Macon, $150,000; Howell-Oregon Electric Cooperative, Inc., West Plains, $125,000; West-Central Electric Cooperative, Inc., Higginsville, $100,000; Grundy Electric Cooperative, Inc., Trenton, $90,000, including construction of substation; Platte-Clay Electric Cooperative, Inc., Platte City, $60,000.

NEW MEXICO—Springer Electric Cooperative, Inc., Springer, $150,000.

NORTH CAROLINA—Albermarle Electric Membership Corp., Hertford, $685,000.

OHIO—Buckeye Rural Electric Cooperative, Inc., Gallipolis, $585,000; North Western Electric Cooperative, Inc., Montpelier, $80,000.

OKLAHOMA—Southwest Rural Electric Assn., Inc., Tipton, $235,000; Canadian Valley Electric Cooperative, Inc., Seminole, $125,000; Cimarron Electric Cooperative, Kingfisher, $101,000; Rural Electric Cooperative, Inc., Lindsay, $100,000; Northfork Electric Cooperative, Inc., Sayre, $80,000; Verdigris Valley Electric Cooperative, Inc., Collinsville, $50,000; Red River Valley Rural Electric Assn., Marietta, $40,000.

TENNESSEE—Volunteer Electric Cooperative, Decatur, $50,000.

TEXAS—Houston County Electric Cooperative, Inc., Crockett, $100,000; Upshur Rural Electric Cooperative Corp., Gilmer, $100,000; Bowie-Cass Electric Cooperative, Inc., Douglassville, $50,000.

UTAH—Escalante Valley Electric Assn., Inc., Modena, $100,000.

VIRGINIA—Shenandoah Valley Electric Cooperative, Dayton, $80,000.

ALASKA—Matanuska Electric Assn., Inc., Palmer, $10,000.

Construction Contracts Approved

ARKANSAS—Ashley-Chicot-Union Electric Cooperative, Inc., Hamburg, contract to Delta Construction Co., Clarksdale, Miss., 181 miles of line; labor and materials, $166,706; engineer, George C. Hengy & Co., Shreveport, La.

COLORADO—Intermountain Rural Electric Assn., Littleton, contract to E. W. Reither, Englewood, Colo., 11.2 miles of line; labor only, $2,777; engineer, Glenn R. Fickel, Denver, Colo.

KENTUCKY—West Kentucky Rural Electric Cooperative Corp., Mayfield, contract to Guy-Townsend Co., Jackson, Tenn., rehabilitation work on 40 miles of line; labor only, $14,945; engineer, Ray W. Chanaberry, Louisville, Ky.

MINNESOTA—Rural Cooperative Power Assn., Maple Lake, contract to Passi & Determan, Sauk Centre, Minn., 30 miles of 34.5-kv. transmission line; labor only $15,127; engineer, Pfeifer & Shultz, Minneapolis, Minn.

MISSISSIPPI—Coahoma Electric Power Assn., Clarksdale, contract to Line Construction Co., Clarksdale, Miss., 6.7 miles of line; labor, poles and conductors, $5,141; engineer, Bowman & Bowman, Greenwood, Miss.

MISSOURI—Barton County Electric Cooperative, Lamar, contract to J. R. Foree, Topeka, Kan., 46.5 miles of line; labor and materials, $52,841; engineer, Frank Horton & Co., Lamar, Mo. Ozark Electric Cooperative, Mt. Vernon, contract to J. R. Foree, Topeka, Kan., 85 miles of line; labor and materials, $96,695; engineer, Frank Horton & Co., Lamar, Mo. New-Mac Electric Cooperative, Inc., Neosho, contract to Killoren Electric Co., Appleton, Wis.,

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Buckingham Equipment Makes Every Day a "Safe Day"

Safety depends as much on equipment as on the man. No lineman is safe unless his equipment is safe.

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AVOID CABLE ABRASION
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STAPUT FAIRLEADERS

"Rubbing at the duct mouth can be reduced by installing fairleaders on the cables at this point."—from Electrical World, May 29, 1943 (Cables—How to Make Them Last).

These non-corrosive alloy cable shields clamp in place to take wear at duct mouth. Easily and safely installed without interruption of service. Eliminate expensive repairs. Use STAPUT FAIRLEADERS. *Write for free catalog.*

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"Head Protector" HATS & CAPS

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A vulcanized fibre helmet with one-piece crown. Lightweight, yet exceptionally strong and impervious to moisture. Available in ten standard sizes, with attached or detachable headband.

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A lineman's belt with 4" abdominal pad of cotton webbing and a belt of diamond-stripe webbing. Metal plates provide additional reinforcement at dees. Lightweight and more flexible than leather belt. Weight, 3 lbs.

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13.8 miles of line; labor and materials, $49,947; engineer, Frank Horton & Co., Lamar, Mo.

NORTH DAKOTA—Verendrye Electric Cooperative, Inc., Velva, contract to Sorkness Construction Co., Fargo, N. D., 58 miles of line; labor and materials, $44,425. North Central Electric Cooperative, Inc., Bottineau, contract to Martin Engineering Co., Fargo, N. D., 17.04 miles of line; labor only, $6,252; engineer, Ulteig Engineering Co., Fargo, N. D.

OKLAHOMA—People's Electric Cooperative, Ada, contract to C & W Construction Co., Ada, Okla., 49 miles of line; labor only, $15,870; engineer, Tulsa Engineering Co., Tulsa, Okla.

OREGON—West Oregon Electric Cooperative, Inc., Vermonia, contract to Armstrong-Bither Construction Co., Vancouver, Wash., 12 miles of line; labor only, $3,998.

TEXAS—Upshur Rural Electric Cooperative Corp., Gilmer, contract to Electric Contracting Co., Shreveport, La., 138 miles of line; labor and materials, $99,422; engineer, Freese & Nichols, Fort Worth, Texas. Lone Wolf Electric Cooperative, Inc., Colorado City, contract to Sanford Construction Co., Oklahoma City, Okla., 15 miles of line; labor and materials, $30,693; engineer, Midwestern Engineers, Tulsa, Okla. Midwest Electric Cooperative, Inc., Roby, contract to Teague and Goodman, Sherman, Texas, 2 miles of line and conversion of 1 mile; labor only, $1,461; engineer, Midwestern Engineers, Tulsa, Okla.

•

Northwest Group Formed to Oppose Proposed CVA

Opposition to the proposed Columbia Valley Authority reportedly is the aim of the Pacific Northwest Development Association, composed of representatives from Oregon, Washington, Idaho, Montana and Wyoming, which organized recently in Portland, Ore.

Rather than policy making by a federal authority, the association is seeking to develop a program for effective partnership of local, state and federal agencies for development of power, irrigation, flood control, navigation and other projects.

Support was pledged post-war projects calling for expenditure of more than $250,000,000 within the jurisdiction of the Portland District Army Engineers.

•

3 N. Y. Towns to Get Power

Central New York Power Corp. has received permission from the New York Public Service Commission to construct facilities to serve a portion of West Turin and Lewis and Highmarket in Lewis County. The corporation has until September to complete most of the work. There is no service now in the three communities except that offered by H. P. Gould in a part of West Turin. Central New York under the order is not allowed to serve any present customer of H. P. Gould.

Practical computations for electrical coils and conductors

This valuable book brings together in one volume for the first time extensive material for the theoretical and numerical computation of coils and conductors. Especially important is the treatment of cylindrical coils without iron cores, and heavy conductors. Among the many problems taken up in detail are magnetic field strength, self- and mutual inductance, mechanical force, skin effect and eddy-current loss. Besides including many helpful illustrative examples, the book gives a considerable number of curve sheets of useful numerical values.

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Their Electrical Characteristics and Theory

By HERBERT B. DWIGHT
Professor of Electrical Machinery, Massachusetts Institute of Technology

348 pages, 5¼ x 8¼, 85 illustrations, $5.00

H. B. Dwight's work in electrical problems is well known in engineering circles. Now this authoritative material on the theory and practice of electrical coils and conductors, with extensive reference material, is easily available in this important new book.

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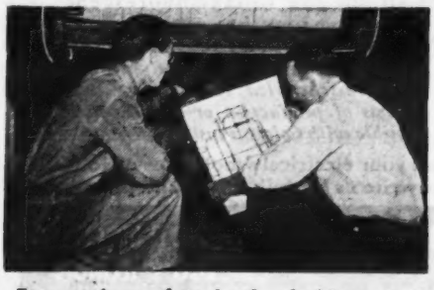
Here are the ten Ozalid "types" and some ways in which you'll save time, labor, and material by using them:

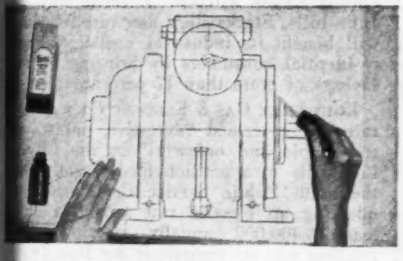


1. OZALID RAPID BLACK
2. OZALID BLUE-LINE
3. OZALID RED-LINE

For routine prints in the drafting room, shop, or office.

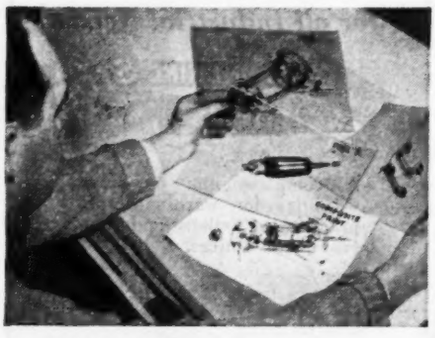
Anything drawn, typed, or printed on translucent material can be reproduced with sharp, easy-to-read images on a white background.

By assigning identifying colors, you can distinguish prints of different departments . . . recognize checked from unchecked prints, etc.



4. OZALID TRANSBLACK
5. OZALID SEPIA-LINE
6. OZALID TRANSPARENT CLOTH

For "intermediates" which may be substituted for originals in subsequent print production. Important savings in time and labor can be realized when design changes are necessary: Obsolete lines are removed with Ozalid Corrector Fluid; changes drawn in and required number of prints made from "new" masters.



7. OZALID FOIL

For composite prints: Details can be printed on individual foils . . . and overlaid to produce a print showing the separate details in relation to each other.

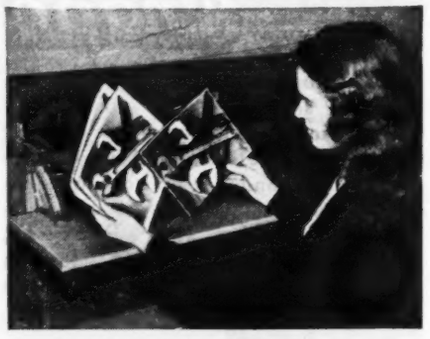
OZALID FOIL also produces faster-printing intermediates from old or worn originals, since it intensifies line detail.

8. OZALID CHARTFILM

For lustrous black-line reproductions on white plastic base, ideal for wiring diagrams, instrument panels, etc. No protective covering is needed; may be cleaned with a damp rag.

9. OZALID OPAQUE CLOTH

For extremely durable prints for shop use, files, etc.



10. OZALID DRYPHOTO

For almost instantaneous, high-quality reproductions of any photographic subject—in sepia, black, or two-tone (blue and sepia) effect.

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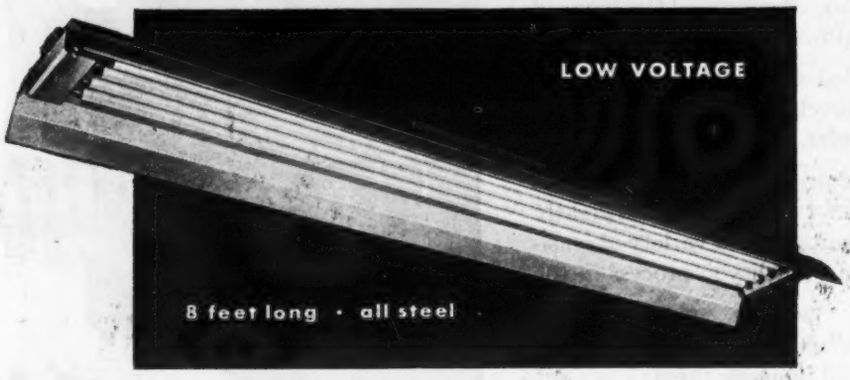

Here is the new Colovolt industrial fixture, one of a complete line of industrial and commercial "packaged" units. Equipped with the standard 93" Colovolt 10,000 hour lamp, Colovolt fixtures may be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage are extra advantages of the Colovolt Cold Cathode low voltage fluorescent lamp. The long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, and *pre-scheduled re-lamping, with no loss of production or time, is now possible with Colovolt installations.*

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ALL the strength and durability inherent in steel are combined---with definite economies---in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

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A complete line of stock wordings for warnings, safe practice reminders and general plant notices.

Attractively finished in baked dulux in adopted color combinations.

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Safety Equipment for all Industries
INDUSTRIAL PRODUCTS COMPANY
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Recent Rate Action

NEW YORK STATE ELECTRIC & GAS CORP. has reduced its summer rates for electricity approximately $45,000 annually in the company's districts including Binghamton, Ithaca, Geneva, Chatham, Plattsburg, Granville, Mechanicville, Oneonta, Brewster, Liberty, Elmira, Corning, Hornell and Perry. Public Service Commission has announced that the lower rates became effective on June 7 in all areas except in the Liberty district where the new schedules will go into effect October 16. The new schedules are designed to standardize the company's seasonal rates as they affect residential consumers and will introduce a commercial rate in the Liberty district where there is a high percentage of summer commercial customers. The residential rate under the revised schedules will add a special provision applicable, upon request, to customers who during a period of six or more consecutive months make only occasional or no use of electric service. Such customers may have service maintained during eight months and they will be billed for consumption at the rate of 5 cents per kilowatt-hour. The total bill for the year will be a minimum of $12. The company's line extension plan is modified to provide a uniform charge of $12 per season in place of the present varying minimums of $18 and $24.

CAROLINA LIGHT & POWER CO., Raleigh, N. C., has been authorized by the South Carolina Public Service Commission to reduce rates affecting the cities of Camden and Bennettsville as much as 15 percent. The power company serves the Pee Dee section of South Carolina. The two cities own their own electric distribution system and purchase slightly more than $100,000 worth of electricity per year.

STARKSVILLE, MISS., has become the seventh distributor of Tennessee Valley Authority power to lower its rate schedule. TVA has announced. The cut amounts to approximately $16,000. Effective with the June bills, Starksville's new rate schedules will benefit its industrial, commercial and residential consumers by bringing over-all savings of more than 17 percent.

LOUISVILLE GAS & ELECTRIC CO.'s electric rates were termed "excessive, unjust, unreasonable and unlawful" by the City of Louisville in a petition filed recently with the state Public Service Commission, requesting an electric rate reduction of at least $3,400,000 annually. Hearing on the petition was set tentatively for June 14.

CAZENOVIA ELECTRIC CO., Cazenovia, N. Y., will reduce its residential rates to consumers by approximately $1,900 annually, effective June 1, 1945. The principal reduction is in the block between 12 and 32 kw.-hr. of use which, under the new schedule, will be 5.25 cents per kilowatt-hour as against the existing rate of 6 cents per kilowatt-hour. A minor revision is also provided in the company's line extension plan.

•

Will Construct Rural Line

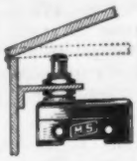
Arkansas Power & Light Co. has been authorized by Arkansas Public Service Commission to construct 10½ miles of 13-kv. line from Cherry Valley to Hickory Ridge to improve voltage conditions in the Harrisburg rice territory and to afford two-way power supply to the city of Wynne.

Only MICRO SWITCH Fills All These Requirements

Thumb Size • Weighs Less Than One Ounce • Millions of Operations • Operating Force as Little as One Ounce • Operating Movement as Little as .0003" • Good Electrical Capacity • 1200 VA-AC

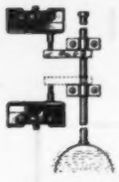
HUNDREDS OF UTILITY APPLICATIONS FOR MICRO SWITCH

Illustrated here are a few of the applications for which Micro Switch has proven accurate and dependable. Micro Switches are backed by a laboratory and engineering staff with years of experience in precision switching. We invite you to submit special switching problems to us.



Cabinet Door Switch. For safety, alarm, or interlock on H.T. cabinets, transmitter or switch compartments. When the door is closed the Micro Switch is actuated, closing the circuit.

Level Gauge. Rod on float-actuated shaft carries arm which operates spring plunger switches at either "high" or "low" position. Signal would remain on until switches are manually reset.

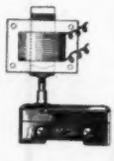


Draft Indicator. A remote damper position indicator can be operated by a cam on a damper shaft and three switches to make contact at "open", "half" and "closed" positions.

Bellows Thermostat. Fluctuations in temperature change the length of the bellows to operate the Micro Switch.

Relay Control. Relay operates Micro Switch to control other circuits.

Solenoid Control. Solenoid, when pulled in, operates a spring plunger Micro Switch to control other circuits.



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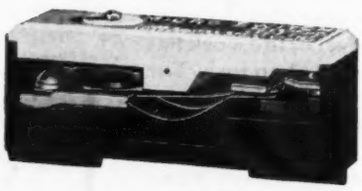
"Uses Unlimited"—a dramatic talking motion picture of Micro Switches, in color, is available to industrial groups, training classes, schools and colleges, through Y.M.C.A. Motion Picture Bureau, New York, Chicago, San Francisco. Size: 16 mm. Length: 40 minutes. Write us for details.

Utilities are rapidly finding more and more uses for the Micro Switch because this small, snap-action precision switch, more fully than any other, fills the needs for a switch to control substantial amounts of power and to operate in small space.

The basic Micro Switch in the Bakelite case is built with various contact separations and in several degrees of sensitivity, some switches requiring as little as 2/1000 ounce-inches of energy for operation. Basic switches are combined with a wide range of easy-to-use housings that provide conduit connections, mechanical protection, and several types of actuators. These housings also provide devices to absorb actuating motion beyond the small movement required to operate the Micro Switch. There are over 2700 variations of housings, actuators and electrical characteristics built around the basic Micro Switch.

Micro Switch is Underwriters' listed and rated at 1200 V.A. at 125 to 460 volts a.c. Capacity on d.c. loads depends on load characteristics.

Micro Switch Handbook-Catalog No. 60 will give you complete details as to electrical characteristics, construction, applications and dimensions. Send for it today.



Cut-away view of Micro Switch which shows clearly the three-bladed beryllium copper spring which is the patented heart of the Micro Switch.

A star has been added to our "E" flag as further recognition to the men and women of Micro Switch for maintaining our war production standards.

Let's All Back the Attack—Buy Extra War Bonds

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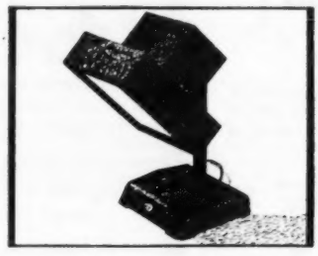
Now! Shop Measurements to *One Millionth of an Inch* With Simple Light Wave Setup!

The wave length of light is the basis for this amazing new optical measuring equipment—which measures millionths of an inch as easily as a micrometer measures tenths! All that is required, in addition to a simple setup, is average eyesight, intelligence and arithmetic.

As shown above, the work was placed under the Monochromatic Light, upon the work and gauge block—and covered by the optical flat. The light, reflected back to the operator, by the top and bottom surfaces of the optical flat, creates interference bands, representing height intervals of 11.6 millionths of an inch. So that from the center of one dark band to the center of the next, the level of the work has risen or fallen 11.6 millionths of an inch. The bands, simply, are a contour map of the surface. This fact, in a simple mathematical formula, is sufficient to explain all the shop uses of optical flats, and give the work measurement, quickly and accurately.

No longer, however, can your dealer give you Wrigley's Spearmint Gum. Today, under present conditions, this product cannot be manufactured up to Wrigley's quality standards. To protect consumer and dealer alike, the makers of Wrigley's Spearmint have decided to keep the quality Wrigley's Spearmint wrapper empty. Remember this wrapper, it means chewing gum of finest quality and flavor.



The Monochromatic Light.

Optical Flat. Surface of Work. Interpretation of bands on truly flat surfaces.

You can get complete information from Acme Scientific Division of Acme Industrial Co., 200 No. Laflin St., Chicago 7, Ill.

Z-72

Recent Legislation

CONNECTICUT — General Assembly has passed HB 809, which would permit the Public Utilities Commission to waive requirements that public service companies file annual audit reports if the income of the company is less than $3,000 a year. Also passed by the General Assembly is HB 1[illegible] which allows the Danbury & Bethel Gas & Electric Co. to purchase electric energy and gas from the Derby Gas & Electric Co.

FLORIDA—Senate has passed and sent to the Governor the bill to allow municipalities to levy a 10 percent utility gross profits tax for their own use. The measure is similar in form to the utility tax proposed by Governor Caldwell except it gives revenue to the cities instead of to the State, as he requested. The tax would not be levied, however, unless residents of the affected area voted for it. The 10 percent municipal tax would be in addition to the one and one half percent tax already levied for state purposes.

NEW YORK—Governor Dewey has vetoed a bill excepting from some of the provisions of the stock corporations law, corporations being reorganized under the National Bankruptcy Act and the Public Utility Holding Company Act. "Serious objections to various provisions of this bill have been raised on matters affecting the protection of the rights of the stockholders and the public," said the governor. "Moreover the state public service commission has requested further opportunity to study the proposed amendments."

OHIO—Governor Frank J. Lausche has signed the Yoder Bill, extending to April 30, 1947, the 0.65 percent utilities tax, estimated to yield between $4,500,000 and $5,000,000 in that period (ELECTRICAL WORLD, May 12, page 194).

CANADA—Royal assent has been given by Lieutenant-Governor Sir Eugene Fiset of Quebec to a bill, authorizing expenditures of $12,000,000 for the setting up of electric cooperatives to promote rural electrification in the Province of Quebec.

•

Idaho Power Will Depend on Independent Dealers

Advertising of the Idaho Power Co. is to be devoted to the promotion of the general use of appliances without any mention of any brand or manufacturer. In this way the advertising will be of benefit to all independent dealers which the company wishes to support as it does not wish to sell electrical merchandise itself, Ralph E. Gale, general sales manager, has announced.

•

Will Use TVA Power

Benton, Ky., which in March, 1941, took over its electrical system from the Central States Power & Light Co., will begin operating with TVA power on July 1. An electric plant board which will operate the municipal system under provisions of the Kentucky TVA Enabling Act has been named by City Council.

The Television Dream That Cables Make Possible

TELEVISION—sign and symbol of the age to come—is one of the wonders that specially designed cable transmission makes practical. For the quality and fidelity of the transmitted image depend largely on how well the cables are engineered and manufactured, from tiny cables in the broadcasting mechanism itself to the great coaxial cables linking city with city, making possible the television networks of the future.

Thus the "wireless age" as it develops will actually need more wires—and more complicated cables—to achieve its realization! And in the solution of these problems, new and more complicated cables will be required.

Today, we will undertake to engineer and manufacture the radio and audio cable requirements of any government agency or private concern in war work. Moreover, we look forward to solving many of the most difficult cable tasks in peacetime—as we have in wartime. The same laboratories, the same Yankee ingenuity that have helped to whip many of the difficulties involved in the communications requirements of our Army and Navy are prepared to function for industry—whatever the problems of today and tomorrow.

Why ANKOSEAL *solves cable problems*

Ankoseal, a thermoplastic insulation, can help solve many electrical engineering problems, now and in the future. *Polyvinyl* Ankoseal possesses notable flame-retarding and oil resisting characteristics; is highly resistant to acids, alkalies, sunlight, moisture, and most solvents. Polyethylene Ankoseal is outstanding for its low dielectric loss in high-frequency transmission. Both have many uses, particularly in the radio and audio fields. Ankoseal cables are the result of extensive laboratory research at Ansonia—the same laboratories apply engineering technique in the solution of cable problems of all types.

THE ANSONIA ELECTRICAL COMPANY

Specializing in "Ankoseal" a Thermoplastic Insulation

ANSONIA • CONNECTICUT

A Wholly-Owned Subsidiary of

NOMA ELECTRIC CORPORATION

GENERAL OFFICES • NEW YORK, N. Y.

—In peacetime makers of the famous Noma Lights—the greatest name in decorative lighting. Now, manufacturers of fixed mica dielectric capacitors and other radio, radar and electronic equipment.

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Consulting Electrical Engineer

Transmission-Distribution, Electric Plants, Sub-Stations
Electrical Designs, Plans & Specifications, Industrial Power Layouts

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Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

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BLACK & VEATCH
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Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

FRANK F. FOWLE & CO.
Electrical and Mechanical
ENGINEERS

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ARTHUR L. MULLERGREN
Engineering-Management
Public Utilities—Natural Gas

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Economic and Business Surveys
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Engineers and Consultants

DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES
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61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

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Consulting Engineers

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BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer

102 Maiden Lane New York

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SANDERSON & PORTER
Engineers - Constructors

FINANCING REORGANIZATION
DESIGN CONSTRUCTION
of
INDUSTRIALS and PUBLIC UTILITIES

Chicago New York San Francisco

DOBLE ENGINEERING COMPANY
Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications.

Office and Laboratory: Medford Hillside, Boston, Mass.
Branch Office: 20 N. Wacker Dr. Chicago, Ill.

HOOSIER ENGINEERING COMPANY
Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
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136 Liberty St., New York

SARGENT & LUNDY
ENGINEERS

140 South Dearborn St.

Chicago, Ill.

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Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

WILLIAM S. LEFFLER
succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases
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Design and Construction
Reports • Examinations • Appraisals
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ELECTRICAL TESTING LABORATORIES INC.

Field and Laboratory Tests
Electrical • Mechanical • Physical
Chemical
INSPECTION • ANALYSIS • RESEARCH
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2 East End Avenue at 79th St., New York 21, N.Y.

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DESIGN, CONSTRUCTION SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

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Expert advice on location and purchase of right of way.
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Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

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1304 St. Paul Street Baltimore 2, Md.

SEARCHLIGHT SECTION

POSITIONS VACANT

DUCTION ENGINEER — fractional h.p. ctric motors. Should have specialty back- d in single phase motors, having devoted effort to efficient mass production. Line have limited size range. Engineering de- experience desirable for development of rs for tooling and production. Permanent ection with outstanding Southern Cali- ia manufacturer entering household ap- ce field. Send details of experience and nal qualifications to A. W. A., Box 68, Station K, Los Angeles, California.

ELECTRICAL CONSTRUCTION Superintend- ent—Electrical superintendent required for installation of electrical equipment in hydro and steam generating stations with units up to 10,000 kw. Location South America. Construc- tion program probably five years or more. For- eign experience desirable but not necessary. P-882, Electrical World, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL ENGINEER familiar with steam power plant work for permanent posi- tion with midwest engineering firm as assistant to head of mechanical engineering section. Good opportunity. Give complete experience record and statement of availability. P-883, Electrical World, 520 N. Michigan Ave., Chi- cago 11, Ill.

RESIDENT ENGINEERS and staking party chiefs experienced rural line construction preferably on REA projects. Permanent work with established engineering firm in Midwest. Give full information and statement of avail- ability. P-884, Electrical World, 520 N. Michi- gan Ave., Chicago 11, Ill.

WANTED: ELECTRICAL Engineers—for lab- oratory research and development work in a well-known New England concern. State qualifications, marital status, age and salary desired. P-890, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ENGINEER — OPERATION, construction, re- building rural electric system. Northern Ohio. Familiarity R.E.A. standards, ability to handle line staking, map work etc., desirable. Eng. Degree or Prof. Lic. not required. Submit full details, qualifications, experience, availability, salary desired. Replies confidential. P-891, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL ENGINEERS: Specialists in var- ious fields to work on fee basis. Important research organization requires outside assist- ance. State qualifications, specialty, back- ground and references. P-892, Electrical World, 330 W. 42nd St., New York 18, N. Y.

WANTED: ELECTRICAL Engineering grad- uate for permanent position as Chief Electrician's assistant in large public utility generating station, located in the East. War Manpower Commission rulings adhered to. P-893, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL DRAFTSMAN: Some experience in power plant and substation design. Loca- tion Buffalo, N. Y. In reply state experience, age, references, salary desired, and when avail- able. P-894, Electrical World, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 35 years recognized standing ne- gotiates for high salaried supervisory techni- cal and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commis- sion's. Retaining fee protected by refund pro- vision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 323 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER, legal training, soon returning from Latin America. Twenty-two years of design and engineering, some construc- tion, of power generation and utilization plants, mostly hydro-electric projects, large and small, also electric system studies and planning. PW- 885, Electrical World, 330 W. 42nd St., New York 18, N. Y.

ELECTRICAL ENGINEER wishes to make con- nection where full use can be made of over fifteen years experience in electrical control, power, industrial electronics, communication, and radio. Will be available after July 1st. PW-895, Electrical World, 330 W. 42nd St., New York 18, N. Y.

METER SUPERINTENDENT: Sixteen years experience transmission and distribution, all phases including relaying and communication. General electric test. Now employed. Clear record. Available sixty days. PW-896, Electri- cal World, 520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

PROTECTIVE RELAY and starting engineer. Twenty years with top Eastern Utility. West coast or New England preferred. PW-897, Elec- trical World, 330 W. 42nd St., New York 18, N. Y.

ACCOUNTANT OR Executive. Have had fifteen years experience in electric and gas utility in general and commercial accounting, property records, customers service etc. Have had super- vision and organization work. Available imme- diately. PW-898, Electrical World, 330 W. 42nd St., New York 18, N. Y.

INSURANCE AND Claims Manager—Twenty- four years public utility experience. Includes administrative safety work. Still employed. Ingenious, capable, bondable. PW-899, Electri- cal World, 330 W. 42nd St., New York 18, N. Y.

AVAILABLE

ELECTRICAL ENGINEER

University Graduate, over 20 years experi- ence in supervisory capacity on design and construction of Coal mines & chemical plants, Large dry docks and large piers, Hydro-steam power plants, Substations of various voltages, Underground distribution systems, Power & Light for various indus- trial Bldgs., Preparing Specs. & Procuring electrical material. Speak Russian. Willing to travel.

PW-887, Electrical World
520 North Michigan Ave., Chicago 11, Ill.

TO REPRESENT MANUFACTURERS
of Electrical Specialties and Components: Bus Bar Ducts, Conduit Fittings, Switches, Fuses, Resistors, Capacitors, Timers.
Representation in New York, New Jersey, Connecti- cut by Engineer with college plus practical electrical background and fine contacts in the Industrial Field.

JAMES A. SMITH CO.
420 Lexington Avenue
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WANTED

Manager for our Machinery and Equipment Department Experienced with machinery and equipment used in heavy industries —like cranes, ground and overhead; steel buildings and structures, power plants, mining, contractors, etc. Draw- ing account and participation. Unusual opportunity for good high grade man. Confidences respected.

IRON & STEEL PRODUCTS, INC.
40 years' experience
13438 S. Brainard Avenue, Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

ELECTRICAL ENGINEER

A Western New York manufacturer of heavy machine tools desires the services of an electrical engineer or experienced draftsman willing to break in on electrical designing.

The work will consist of designing con- trol panels, switchboards and electrical systems of large machine tools.

This opening is permanent to the right man and offers excellent post-war pros- pects with well established, nationally recognized tool manufacturer.

Apply by letter, stating age, experience, education and other pertinent data. W.M.C. rules apply.

P-880, Electrical World
330 West 42nd St., New York 18, N. Y.

ELECTRICAL DESIGNERS

Experienced in Design of Power & Indus- trial Plants

EBASCO SERVICES, INC.
2 Rector St. N.Y.C. 6

WANTED

ELECTRONICS RADIO & MECHANICAL ENGINEERS

An unusual opportunity is offered ambitious capable engineers who have had qualifying experience in the design, development & preparation for manufacture of radio & industrial elec- tronic equipment. Experi- enced with dielectric & in- duction heating equipment desirable but not essential.

Important war work now with large post war projects to follow.

RADIO RECEPTOR CO.
251 W. 19 St., New York 11, N. Y.

Electrical Engineer —Transformer Design Specialists

Chicago Transformer Manufacturer offers excellent present and postwar position for an electrical engineer who has had trans- former design experience on large and small, power, distribution, and air cooled industrial and public utility transformers. This company is fifty years old and is enlarging its manufacturing facilities. Right man has opportunity of establishing life- time connection with exceptional future and high salary. Communicate in writing, giving experience, etc. We will arrange for personal interview at our expense. All replies will be kept strictly confidential.

Write

P-888, Electrical World
520 N. Michigan Avenue, Chicago 11, Ill.

ELECTRICAL ENGINEERS

Experienced graduate engineers wanted by old consulting engineering organiza- tion located in New York City. Opening for power station, substation and indus- trial design engineers. Also engineer ex- perienced or interested in training for work on corrosion and cathodic protection of buried metal structures. Also experi- enced distribution engineer thoroughly qualified for economic studies, design lay- outs, equipment specifications and super- vising preparation construction drawings for electric utility systems and industrial installations. Applicants please state age, education, experience record, draft status, and salary desired.

P-874, Electrical World
330 W. 42nd St., New York 18, N. Y.

(Additional Employment Advertising on page 210)

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad Is Owned Outright By Us

D C MOTORS

	HP	Make	Type	Volts	Speed
2—	1250	G.E.	MPC	550	160
1—	1200	Whse.	Compen.	550	600/720
1—	800	G.E.	MPC	660	600
1—	700	G.E.	MPC	250	200/360
2—	625	G.E.	MPC	500	160
1—	600	G.E.	MPC	600	650/900
1—	500	G.E.	MPC	230	900
1—	500	Whse.	Compen.	250	800/720
1—	350	G.E.	MPC	220	460
1—	300	G.E.	MPC	230	275/550
1—	250	Al. Ch.		230	525
2—	200	Whse.		230	400
1—	175	Whse.	SK	250	150/525
1—	150	G.E.	MPC	230	250/450
2—	130	Cr. Wh.	CMC-65H	550	1200
2—	125	G.E.	CO-	230	625
1—	100	G.E.	LC-50	230	1200
1—	100	G.E.	MPC	230	225/450
1—	100	G.E.	RC-38	230	600
1—	75/100	Whse.	SK-183	230	450/900
1—	75	G.E.	LC	230	500/1000
2—	75	Whse.	SK-183	230	560/1100
1—	60	Al. Ch.	E-131	115	1750
1—	60	El. Dy.	25S	230	424/1050
2—	50/60	Cr. Wh.	65H	230	500/1000
1—	50	Cr. Wh.	CMC-81H	230	300/900
1—	50	G.E.	RC-19	230	400/1200
2—	40	El. Dy.	30S	230	300/900

TRANSFORMERS

	KVA	Make	PH	Type	Voltage
3—	1667	Pitts	1	OISC	13200x2300
1—	1050	G.E.	3	WCTH	11000x445
4—	525	G.E.	1	HJDD	2300x445
4—	500	Pitts.	1	OISC	13200x2300
3—	333	Moloney	1	C-OISC	22000/11000x2300/575
2—	333	Whse.	1	OISC	2300x460
2—	333	Pitts.	1	OISC	2400x220
3—	300	G.E.	1	H-RP	13200x575/1150/2300
1—	300	Pitts.	3	ODSC	4150x208/120
3—	200	G.E.	1	H-IDD	6400x115/460

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 275 V. Gen. d.c. to 2100 HP 2300 V.
1—1000 KW G.E. 250 V. DC to 1400 HP 2300 V.
1—1000 KW Whse. 600 V. Gen. d.c. to 2000 Kva—2200 V.
1—750 KW Whse. 275 V. Gen. d.c. to 1100 HP 2300 V.
1—750 KW G.E. 250 V. Gen. d.c. to 1080 HP 2300/4150 V.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
1—400 KW GE 250/275 V. Gen. d.c. to 650 HP 2300 V.
1—350 KW GE 220 V. AC Gen. d.c. to 500 HP 250 V. DC motor.
1—240 KW Whse. 125 V. Gen. d.c. to 350 HP 440 V.
1—200 KW GE 125 V. Gen DC to 300 HP—440 V.
1—75 KW GE 125 V. Gen to 120 HP IK 400/2300.
1—50 KW GE 125 V. Gen. to 75 HP KT 4000/2300 V.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

ROTARY CONVERTERS

60 Cycle

	KW	Make	Speed	D.C. Volt	Trans. Volts
1—	1500	Whse.	720	600	2300
1—	1500	Whse.	600	600	11500
1—	1250	G.E.	720	250	2300
1—	1000	G.E.	900	600	13200
1—	1000	Whse.	900	600	11000
1—	750	G.E.	1200	600	2300
1—	750	Whse.	720	250	6600/2300
1—	500	Whse.	1200	600	13200/2300
1—	300	Al. Ch.	1200	250	2300
2—	300	G.E.	1200	600	2300

25 cycle

2—	1500	G.E.	500	225/275	13200/6600
1—	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC controls.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts
2—	2100	G.E.	ATI	2300/4
1—	600	Al. Ch.		2300
2—	200	G.E.	TS-7644	2200
1—	75	G.E.	TS-7556	2300/440

Slip Ring

1—	1200	Cr.-Wh.	801-Q	220
1—	800	Al. Ch.		440
1—	600	G.E.	MT	550
1—	600	Cr. Wh.	131-AQ	2300
1—	500	Al. Ch.	ANY-36	2300
1—	450	Whse.	CW	2200
1—	400	Al. Ch.		2300
1—	400	G.E.	IP	2200
1—	350	G.E.	MT-442y	550
1—	250	G.E.	MT	4000/2300
2—	250	Whse.	CW	2300
1—	100	G.E.	IM	220
1—	100	G.E.	IM	2200

Squirrel Cage

1—	300	Whse.	CS	550
1—	300	G.E.	IK-17	440
1—	200	G.E.	IK	550
1—	175/112	G.E.	IK	440
1—	150	Whse.	CS	550
1—	100	Whse.	CS	2200

SYNCHRONOUS CONDENSERS

1—	5000	Whse.		2300/4
1—	3000	Al. Ch.		2300
1—	2000	G.E.	ATI	600
1—	2000	Whse.		2400
1—	1000	G.E.	ATI	200/380
1—	750	G.E.	ATI	220/440

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

Wanted: CHIEF ENGINEER

By a well established Midwestern Mfr. of Specialties for transmission & distribution lines.
Duties—Supervision of Product Engineering Division of Company. This Dept. does research & design on new and old products.

Experience—Graduate Electrical Engineer. Should have experience with transmission & distribution lines and experience in supervision of Engineering Dept.
Permanent position—good salary. When applying give full details of past experience.

P-876, Electrical World, 520 North Michigan Ave., Chicago 11, Ill.

Electrical Distribution Engineers

wanted by central office of 30 rural distribution cooperatives. Preference given to ex-servicemen. Positions permanent. WMC rules apply. Write

WISCONSIN ELECTRIC COOPERATIVE
303 E. Wilson St. Madison, Wis.

WANTED
SALES ENGINEERS

Experienced electrical men, familiar with low voltage distribution systems to act as sales specialists in important District Offices on following: Panelboards, safety switches, enclosed circuit breakers, bus duct and load centers. Men accepted to receive full training at factory at company's expense before assignment. Write to Supervisor, Technical Employment, 306 Fourth Avenue, Pittsburgh, Pennsylvania, for application form.

WESTINGHOUSE
Electric Corporation

WANTED

To Purchase Electric Utility in small community under 2000 population. Either steam, Diesel or High Line source.

Address: P. O. Box #207
Hollywood #28, Calif.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED
Two Rector St. New York 6, N. Y.

WANTED
SALES EXECUTIVE

Company Manufacturing Electrical Switchboards requires executive to sell, nationally, electrical switchboards, control devices and sheet metal products to electric contractors and to manufacturers.

Essential Requirements

Ability to recognize active markets, knowledge of how to sell them.
A good Electrical background.
Familiarity with the industry, knowledge of switchboard construction, Electric Control Devices, Sheet Metal Fabrication.

Submit Resume. State Salary. Age. N. Y. Factory.

SW-886, Electrical World
330 West 42nd St., New York 18, N. Y.

WANTED
POWER SALES ENGINEER

Power and light company serving Northern New Jersey has opening for man about 35 years of age. Must be graduate Electrical Engineer, with general experience in power sales work.

Good starting salary and excellent opportunity for post-war advancement.

Write giving full qualifications and send photo.

SW-889, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

POWER FOR PRODUCTION

MOTOR GENERATOR SETS

1—75 KW, 125 volt, General Electric, squirrel cage.
1—15 KW, 250 volt, General Electric, squirrel cage.
1—7½ KW, 125 volt General Electric, squirrel cage.

MOTORS—3 PHASE 60 CYCLE

1—300 H.P., 900 RPM, 440 volt, Lincoln slip ring.
1—400 H.P., 220 volt, 1200 RPM, Westinghouse squirrel cage.
1—350 H.P., 300 RPM, 400 volt, General Electric slip ring.
1—250 H.P., 600 RPM, 2200 volt, General Electric slip ring.
1—200 H.P., 1800 RPM, 220 volt, General Electric slip ring.
1—200 H.P., 600 RPM, 550 volt, Westinghouse slip ring.
1—200 H.P., 600 RPM, 440 volt, Crocker-Wheeler slip ring.
1—150 H.P., 1800 RPM, 440 volt, General Electric squirrel cage.
1—150 H.P., 1800 RPM, 220 volt, Westinghouse slip ring.
1—150 H.P., 400 RPM, 440 volt, General Electric squirrel cage.
1—100 H.P., 720 RPM, 440 volt, General Electric slip ring.
1—100 H.P., 600 RPM, 2200 volt, General Electric slip ring.
1—100 H.P., 450 RPM, 440 volt, General Electric squirrel cage.
1—100 H.P. 1800 R.P.M., 440 volt, G. E. squirrel cage.
1—85 H.P. 900 R.P.M., 220 volt, G. E. synchronous.
1—75 H.P. 900 R.P.M., 220 volt, G. E. slipring.

Gasoline Driven Generator Sets

2—25 KW, 125 volt, direct current
130 KW, 125 volt, direct current

1— 90 H.P., 400 RPM, 650 volt, Crocker-Wheeler squirrel cage.
1— 75 H. P., 900 RPM, 4000 volt, Electric Machinery synchronous.
1— 75 H.P., 720 RPM, 440 volt, Westinghouse slip ring.
1— 60 H.P., 1200 RPM, 440 volt, General Electric slip ring.
1— 50 H.P. 1200 R.P.M. General Electric, Squirrel Cage.
1— 50 H.P., 900 RPM, 440 volt, General Electric slip ring.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, G.E.
1—250 HP, 760 RPM, Electro Dynamic
2—125 H.P. 950 R.P.M. G.E.
1—100 HP, G.E., 575 RPM.
1— 50 HP, 750 RPM, Westinghouse, type SK.
1— 50 HP, 700 RPM, Crocker-Wheeler.
1— 40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—75 KVA, G.E., 13500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
2—50 KVA, Phgh., 7500/15,000 volts-110/220 volts.
3—50 KVA, Pittsburgh, 2200-220/110.
3—37½ KVA, General Electric, 2200/220/440
1—25 KVA, G.E., 220/110-20/110 volts.
3—25 K.V.A. G. E. 2200—220/110.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11¼ HP, 500/1500 RPM, Westinghouse, type, SK.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

INSTRUMENTS

25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

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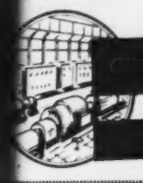
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.



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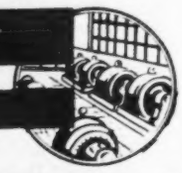

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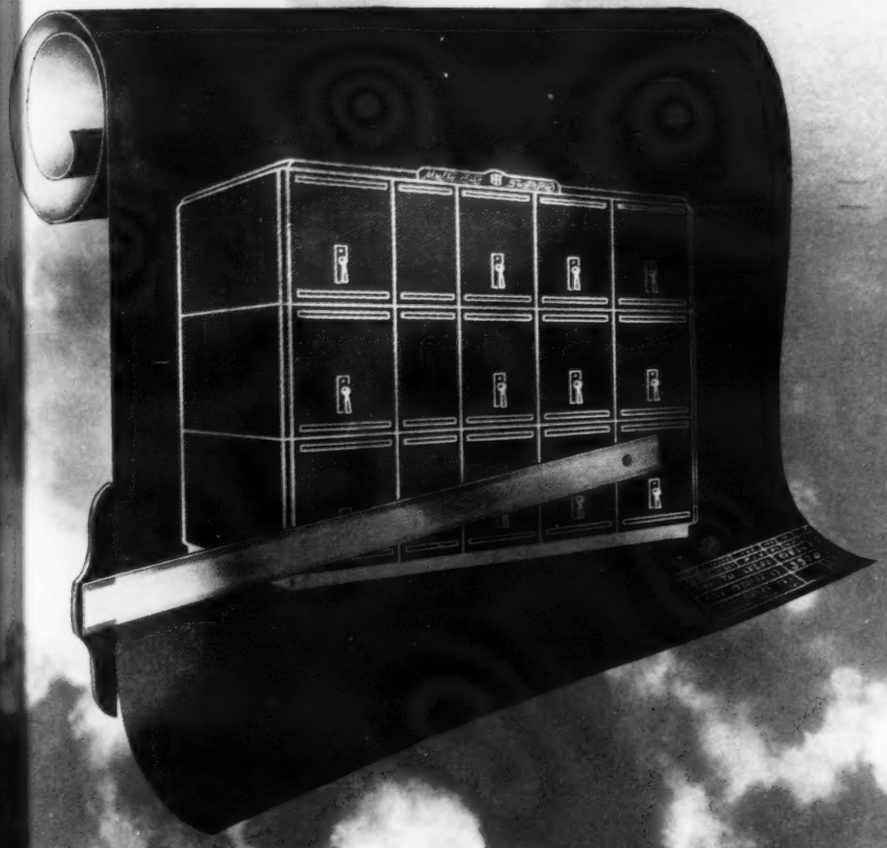

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